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Computer search for layer materials that maximize the reflectivity of X-ray multilayers

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Résumé. — La réflectivité des miroirs multicouches est optimisée en sélectionnant des matériaux à l'aide d'une base de données de coefficients atomiques. Les performances maximum et les matériaux correspondants sont indiqués pour 63 longueurs d'onde espacées régulièrement sur une échelle logarithmique s'étendant de 6 à 124 Å. Des formules de calculs rapides permettant une telle sélection sont présentées. Un choix de plusieurs combinaisons de matériaux utilisables est indiqué en fonction de différents critères. Très fréquemment les couples de matériaux donnant la meilleure réflectivité au sommet du pic de Bragg fournissent aussi la meilleure réflectivité intégrée, mais certains couples n'optimisent qu'un des deux types de réflectivité.

Abstract. — A database of atomic scattering factors [1] is exhaustively searched for layer materials that potentially maximize collection solid-angle in a multilayer mirror. Maximum attainable performance and corresponding materials are provided at 63 logarithmically spaced wavelengths in the soft X-ray region ($6 \text{ Å} < \lambda < 124 \text{ Å}$). Computationally rapid formulas that enable an efficient search are presented. Only a cursory screening is made of material suitability, but a number of possible materials combinations are provided at each wavelength, selected according to several different criteria. Materials-pairs which maximize peak reflectivity often provide high integrated reflectivity as well, but materials rankings by peak and integrated reflectivities show distinct differences.

Introduction.

Materials considerations have been crucial in the development of X-ray multilayer reflectors. Materials choices have been [2, 3] and remain [4] a topic of interest in the X-ray multilayer literature. The related matter of multilayer performance and structural quality has been described as a dominant topic of the genre [5]. Analyses of the reflecting properties of multilayers have dealt with both idealized structures, and with various types of imperfections (see for example the contents and cited references in recent articles by Barbee [4], Henke *et al.* [6], and Spiller and Rosenbluth [7]).

In this paper we consider only the ideal case of high-index/low-index periodic multilayers that operate in the extinction limit (i.e. large number of layers). The analysis of Vinogradov and Zeldovich [8] then makes it possible to rapidly calculate the maximum reflectivity obtainable from a particular

pair of materials at a given X-ray wavelength. Elaborating on previous work [9], we show how this analysis can be developed into approximate formulas for optimized integrated reflectivity, or collection solid angle in the case of a focussing reflector. It then becomes feasible to search efficiently through all possible pairs of multilayer materials, thereby establishing the upper limits of multilayer performance, and uncovering potentially useful materials.

Computations.

Using the notation of a previous publication [7] the results of Vinogradov and Zeldovich [8] imply the following simple form for peak reflectivity :

$$R_{\text{peak}} = \frac{4 R_{12} \sin^2 \gamma}{(A + B)^2}, \quad (1)$$

where R_{12} is the reflectivity of a single high-low interface,

$$\begin{aligned}
 R_{12} &= |r_{12}|^2 = \left| \frac{n_1 \cos \alpha_1 - n_2 \cos \alpha_2}{n_1 \cos \alpha_1 + n_2 \cos \alpha_2} \right|^2 && \text{(s-polarization)} \\
 &\cong \frac{1}{4} ([n_1' - n_2']^2 + [n_1'' - n_2'']^2) \sec^4 \alpha_0 && \text{(s-polarization)} \\
 &= \left| \frac{n_1 \cos \alpha_2 - n_2 \cos \alpha_1}{n_1 \cos \alpha_2 + n_2 \cos \alpha_1} \right|^2 && \text{(p-polarization)} \\
 &\cong \frac{1}{4} ([n_1' - n_2']^2 + [n_1'' - n_2'']^2) \cos^2 (2 \alpha_0) \sec^4 \alpha_0 && \text{(p-polarization)}
 \end{aligned} \tag{2}$$

with primes and double-primes denoting real and imaginary parts, n_1 and n_2 the refractive indices of the two layer materials, and α_0 , α_1 and α_2 the angles of incidence and propagation in the incident and film media. γ is a parameter in radian units which specifies the division of the multilayer unit period between the two materials; $\gamma \equiv \pi d_1/p$, with $p \equiv d_1 + d_2$ the multilayer period. For simplicity, we let the subscript 1 denote the high index layer (in the sense of $n_1'' > n_2''$), and subscript 2 the low index layer. The quantities A and B are defined as

$$A \equiv \sqrt{\mu''^2 + (2 r_{12}' \sin \gamma)^2} \tag{3}$$

$$B \equiv \sqrt{\mu''^2 - (2 r_{12}'' \sin \gamma)^2} \tag{4}$$

where μ is the complex optical phase dispersion in propagating through the unit period [10],

$$\begin{aligned}
 \mu(\alpha_0) &= \frac{2\pi}{\lambda} \times \\
 &\times \left(\left[\int_{\text{period}} dz n(z) \cos \alpha(z) \right] - p \cos \alpha_0 \right) \tag{5}
 \end{aligned}$$

with the *local angle of refraction* defined by $n(z) \sin \alpha(z) \equiv \sin \alpha_0$. In the X-ray regime

$$\mu(\alpha_0) \cong \frac{2p}{\lambda \cos \alpha_0} (\pi [n_2 - 1] + \gamma [n_1 - n_2]). \tag{6}$$

Equation (1) is essentially a real expression for the peak intensity in a general complex Darwin-Prins solution, based on the assumption $(n_{1,2} - 1) \sec^2 \alpha \ll 1$. This equation has the approximate form of a single-period reflection, multiplied by the square of the number of participating periods. Equations (1) and (6) as written assume ideal multilayer structures, having sharp layer boundaries.

The condition for maximizing R_{peak} is

$$\tan \gamma = \gamma + W \tag{7}$$

(see Eq. (23) and associated discussion in Ref. [8]), where

$$W \equiv \frac{\pi (n_2'' - 1)}{n_1'' - n_2''}. \tag{8}$$

Equation (7) can be solved iteratively with the formulas [9]:

$$\begin{aligned}
 \gamma_0 &= \sqrt[3]{3W - 2.5 \left(\frac{W}{1+W} \right)^{5/3}}, \\
 \gamma_{i+1} &= \gamma_i - \frac{\tan \gamma_i - \gamma_i - W}{\sec^2 \gamma_i - 1}, \quad (W < 0.66) \\
 \gamma_0 &= \frac{1}{2} \left[\pi - \left(W + \frac{\pi}{2} \right) + \sqrt{\left(W + \frac{\pi}{2} \right)^2 - 4} \right], \\
 \gamma_{i+1} &= \arctan (\gamma_i + W), \quad (W > 0.66)
 \end{aligned} \tag{9}$$

In the soft X-ray regime multiple reflections between the thin-films are often small, and the reflectivity as a function of Bragg detuning can be approximated with a Lorentzian [11]:

$$R(\phi) = \frac{R_{12} \sin^2 \gamma}{(\phi - \mu')^2 + \mu''^2},$$

where

$$\phi \equiv \pi - \frac{2\pi p \cos \alpha_0}{\lambda}. \tag{10}$$

Here the parameter ϕ defines the detuning from the nominal Bragg resonance (taken for simplicity as first-order).

Equation (10) can be used to estimate the collec-

Fig. 1. — Schematic diagram of a focussing multilayer (with figured substrate). Collection solid-angle is maximized if the reflection peak is detuned slightly from normal incidence.

tion solid angle of a multilayer focussing collimated radiation, as in figure 1. (See also the detailed computational study in Ref. [12]). The estimate of $\Omega_{\text{collection}}$ takes a particularly simple form when the α -dependence can be neglected in all terms other than ϕ . Such neglect is usually accurate in the X-ray regime, where significant reflectivity is achieved with many layers and a narrow bandpass; however the resulting expressions become less accurate in the soft X-ray regime. If we let α_B denote the nominal

Bragg angle (at which ϕ is zero), we have from figure 1 that

$$d\Omega = 2\pi \sin \Theta d\Theta \cong 8\pi \cos \alpha_B d(\cos \alpha),$$

again assuming that terms varying as $\cos \alpha$ are effectively constant over the multilayer bandpass. (Note that, in contrast, terms varying as $\sin \alpha$ can only be treated as constant away from normal incidence.)

We then have :

$$\begin{aligned} \Omega_{\text{collection}} &\equiv \int R(\Omega) d\Omega \\ &\cong 8\pi R_{12}(\alpha_B) \cos \alpha_B \sin^2 \gamma \int_0^1 \frac{d(\cos \alpha)}{\left(\frac{2\pi p}{\lambda}\right)^2 ([\cos \alpha_B - \mu'(\alpha_B)] - \cos \alpha)^2 + \mu''^2(\alpha_B)}. \end{aligned} \quad (11)$$

Equation (11) applies at all Bragg angles outside the grazing regime, including normal incidence, and can of course be integrated analytically. However, for simplicity we now assume that α_B is sufficiently far from 0° that both sides of the reflectivity curve are realized at physical angles (i.e. $\geq 0^\circ$). Using $2p \cos \alpha_B \cong \lambda$, and considering the limiting case where the integral contains the full area of the Lorentzian :

$$\begin{aligned} \Omega_{\text{collection}} &\leq \frac{8\pi \cos^3 \alpha_B}{\pi^2} R_{12}(\alpha_B) \sin^2 \gamma \times \\ &\quad \times \frac{\pi}{\mu''(\alpha_B) \frac{\lambda}{2\pi p}} \\ &\cong 8\pi R_{\text{peak}} \mu''(\alpha_B = 0). \end{aligned} \quad (12)$$

This simple expression for $\Omega_{\text{collection}}$ has the form of a peak reflectivity, multiplied by a bandwidth and a trigonometric factor. Note that if the multilayer is tuned for a reflection peak at precise normal incidence, only about one-half the solid angle in equation (12) will be realized.

With s-polarization, $R_{\text{peak}} \mu''(\alpha_B = 0)$ is independent of α_B . With un-polarized radiation, R_{peak} may be approximated as an average over both polarizations.

$\mu''(\alpha_B = 0)$ is the imaginary part of the complex phase thickness (at normal incidence), and is essentially the reciprocal of the absorption-limited number of participating layer pairs. The μ'' in equation (12) thus neglects primary extinction, and so equation (12) often overstates the number of participating layers in highly reflecting structures. A more suitable upper limit on $\Omega_{\text{collection}}$ is obtained by replacing μ'' with the extinction-limited number of layer pairs, which is the reciprocal of the imaginary

part of the equivalent phase thickness [9, 10, 13]. Here *equivalent phase thickness* refers to the analytic reduction of a multilayer stack to a single equivalent layer (as here), or to a pair of equivalent layers [14]. In terms of the parameters A and B defined above, the imaginary part of the equivalent phase thickness for an X-ray multilayer can be written

$$g_{\text{peak}} = \frac{AB}{\mu''(\alpha_B)}. \quad (13)$$

Note that unlike μ , g is polarization-dependent away from normal incidence.

We thus have as an approximate upper limit on collection solid-angle :

$$\Omega_{\text{collection}} \leq \Omega_{\text{max}} \equiv 8\pi \frac{R_{\text{peak}}(\text{s-polarization})}{N(\alpha_B = 0)} \quad (14)$$

where the effective number of participating periods is given by

$$N \equiv \frac{1}{g_{\text{peak}}}, \quad (15)$$

with g_{peak} and R_{peak} defined by equations (1-6, 13). These expressions essentially involve only real arithmetic.

In the 100 eV range N is often of order 10 for an optimized multilayer (with typical scaling $N \sim (h\nu)^2$, or, at short wavelengths where operation at normal incidence is infeasible, as $N \sim \cos^2(\alpha_B)$). Since $R(\alpha_0)$ is Lorentzian-like, it has very broad tails, particularly near normal incidence. However, $\Omega_{\text{collection}}$ approaches the limit in equation (14) only to the extent that the full two-sided resonance in $R(\alpha)$ is realized at angles sufficiently close to normal incidence that polarization effects can be

neglected. In addition, use of g_{peak} sometimes overstates collection solid-angle. We have found by numerical integration that in the 100 eV range the collection solid angle actually approaches only about 50 % of the limit in equation (14). The limit would in principle be approached more closely at shorter wavelengths, except that the reflection must be increasingly annular in order to maintain a reasonable period length.

The above figure of merit $8 \pi R_{\text{peak}} g''_{\text{peak}}$ can also be regarded as an approximate index for the one-dimensional integral of reflectivity over angle, to within a different normalization constant :

$$R_{\text{integrated}} \equiv \int R(\alpha) d\alpha \quad (16)$$
$$\cong \frac{2 R_{\text{peak}} g''(\alpha_B = 0)}{\sin 2 \alpha_B} .$$

Equations (7, 9) optimize peak rather than integrated reflectivity. To maximize integrated reflectivity,

we use numerical optimization from the starting value :

$$\gamma_0 = \frac{\pi}{2} - \frac{1}{(2W + \pi) - \frac{2}{(2W + \pi)}} . \quad (17)$$

Equation (17) is obtained from equation (14) by setting $g''_{\text{peak}} \equiv \mu''$, differentiating with respect to γ , and setting $\tan \gamma \equiv \left(\frac{\pi}{2} - \gamma \right)^{-1}$.

Materials search.

The results of a sort across all possible pairs of the natural elements is shown in table I (at the end of the paper). The sorting parameter used by the program is the quantity Ω_{max} defined in equation (14), which is the entry in the table labelled *SOLID ANGLE*. The search program prints several different lists of materials for each wavelength. Figure 2 shows the detailed criteria on which the different lists are based.

Explanation of Different Entries at Each Wavelength

	Wave-length	Solid angle	R	N	Gamma	Element-H	Element-L
		Steradians		At normal incidence	$\frac{DH}{DH + DL}$		
Best pair of materials at particular wavelength.	124.00	2.3624043	0.8380	8.9	0.4474	Rhodium	Silicon
Second through fourth best pairs.	124.00	2.3355276	0.8339	9.0	0.4457	Ruthenium	Silicon
	124.00	1.6723551	0.7672	11.5	0.4366	Molybdenum	Silicon
	124.00	1.5383509	0.5851	9.6	0.4030	Silver	Silicon
Second through sixth best pairs, with no previously selected materials allowed in pairs that follow.	124.00	1.4281216	0.7705	13.6	0.4416	Ruthenium	Strontium
	124.00	0.8933189	0.4032	11.3	0.4192	Silver	Calcium
	124.00	0.7119088	0.2961	10.5	0.4480	Barium	Molybdenum
	124.00	0.5215018	0.2230	10.7	0.4310	Gold	Praseodymium
	124.00	0.4224630	0.2266	13.5	0.4241	Platinum	Yttrium
Second through seventh best pairs, with no previously selected low index material allowed as low index material in following pairs.	124.00	1.4481903	0.7761	13.5	0.4433	Rhodium	Strontium
	124.00	1.3641634	0.6757	12.4	0.4849	Rhodium	Calcium
	124.00	1.1324938	0.4139	9.2	0.4428	Barium	Rhodium
	124.00	1.1252474	0.4080	9.1	0.4444	Barium	Ruthenium
	124.00	1.1049286	0.5881	13.4	0.4956	Rhodium	Yttrium
	124.00	1.0718544	0.6437	15.1	0.4791	Rhodium	Boron
	124.00	1.0476324	0.5755	13.8	0.4962	Rhodium	Cerium
Six best pairs containing carbon, or second through seventh such pairs if best overall pair contains carbon.	124.00	1.1125064	0.7428	16.8	0.4574	Carbon	Silicon
	124.00	0.8789213	0.5503	15.7	0.4920	Rhodium	Carbon
	124.00	0.8661509	0.5426	15.7	0.4898	Ruthenium	Carbon
	124.00	0.6193523	0.3020	12.3	0.4287	Silver	Carbon
	124.00	0.4147207	0.2218	13.4	0.4190	Gold	Carbon
	124.00	0.3399269	0.3247	24.0	0.4774	Molybdenum	Carbon

(By definition, the low index material in a pair is the material with the least absorption.)

Fig. 2. — Breakdown of the entries in table I. The sort by maximum $\Omega_{\text{collection}}$ is carried out under several different constraints, each resulting in a separate subgroup.

The table also lists the peak reflectivity (R), the γ value that optimizes $\Omega_{\max}$, and the number of layer pairs N required to approach this performance (as per Eq. (15)).

It must be emphasized that these results are purely theoretical. No effort has been made to assess the individual suitability or joint compatibility of the chosen materials, in terms of the quality or stability of either the layers or their interfaces. Bulk densities are assumed in the layers, which tends to overstate the integrated reflectivity. A crude materials screening has been imposed by the requirement that the elements considered have melting points above 270° (i.e. above that of bismuth). Beryllium and all radioactive elements were excluded. (Unlike other toxic elements, beryllium would have been frequently selected by the search program had it been included, due to its low atomic number.)

Only elemental films have been considered in the search, whereas it is known that a crucial smoothening can sometimes be obtained by alloying two materials [15]. This an important consideration, since interfacial smoothness can be a dominant factor in determining overall reflectivity. Films with high electron-density are generally metallic, and in the single-element case are likely to show excessive grain-size.

However, to a reasonable approximation, the nominal performance obtained by alloying two elements that appear singly in the table can be estimated as a weighted average of the table entries, due to the weak atomic scattering in the X-ray regime. In other words, alloying might allow an evaporated film to approach more closely the ideal performance levels calculated in the table.

Table II (at the end of the paper) presents the result of a materials search to optimize peak reflectivity, based on equations (1, 7, 9). Only the materials-pair that provides the highest nominal R_{peak} is listed at each wavelength.

Conclusions.

Tables I and II suggest that continued expansion of the fabricators' art may yield multilayers with significantly higher performance than is commonly achieved at present.

Of course, there are many qualifications to be

made about the results of an optimization study such as this. The results in the tables are at best suggestive, and indicative of the upper limits of multilayer performance, as established by the properties of available materials in nature. (In the latter regard, however, it should be noted that the search has not considered the use of beryllium or hydrocarbon films, nor such exotic possibilities as free-standing or partially-supported films. Collection solid-angle can also be increased by stepping or grading the d -spacing [12, 16].)

Materials-pairs that yield high peak reflectivity tend to be among those that yield high integrated reflectivity (with some exceptions), but the theoretically attainable maximum reflectivity can sometimes be significantly increased when the structure and materials optimize peak rather than integrated reflectivity. This is often most pronounced where low absorption makes possible designs achieving large R_{peak} via small g_{peak} .

The surprisingly high performances in the tables are generally associated with the low absorption and anomalous dispersion (especially $f_1 < 0$) that are present in the vicinity of atomic resonances (see also Ref. [17]); these edges have been conveniently tabulated by Henke *et al.* [1].

Of course, the optical constants data may well be less reliable in such regions; this may be particularly true in the case of more exotic elements. Database searches of the present sort tend intrinsically to be biased in favor of less accurate data, where the error happens to improve the calculated performance. On the other hand, it is perhaps encouraging that systematically high performance is predicted from certain film materials over wide portions of the spectrum (e.g. osmium, iridium, rhodium, ruthenium, nickel, magnesium, as well as the more familiar tungsten, rhenium, carbon and boron). Many other materials are selected in more limited portions of the spectrum.

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Table 1. — High-index/low-index pairs of materials that maximize collection solid-angle, at each of 63 logarithmically-spaced wavelengths between 6 Å and 124 Å. See figure 2 for an explanation of the five subgroups at each wavelength. For simplicity the table entries are calculated at normal incidence (even for very short wavelengths), but the scaling to other angles (outside the grazing regime) is straightforward.

MINIMUM 2 ALLOWED IS 5											
WAVE- LENGTH	SOLID ANGLE	R	N	GAMMA (DB) (NORMAL) (-----) (DB + DL)	ELEMENT - B	ELEMENT - L					
(STERAD.)											
124.00	2.3624043	.8380	8.9	.4474	RHODIUM	SILICON					
124.00	2.335276	.8339	9.0	.4457	RUTHENIUM	SILICON					
124.00	1.6723551	.7672	11.5	.4366	MOLYBDENUM	SILICON					
124.00	1.5383509	.5851	9.6	.4030	SILVER	SILICON					
124.00	1.4281216	.7705	13.6	.4416	RUTHENIUM	STRONTIUM					
124.00	.8933189	.4032	11.3	.4192	SILVER	CALCIUM					
124.00	.7119088	.2961	10.5	.4480	BARIUM	MOLYBDENUM					
124.00	.5215018	.2230	10.7	.4310	GOLD	PRASEODYMIUM					
124.00	.4224630	.2266	13.5	.4241	PLATINUM	YTTRIUM					
124.00	1.4481903	.7761	13.5	.4433	RHODIUM	STRONTIUM					
124.00	1.3641634	.6757	12.4	.4849	RHODIUM	CALCIUM					
124.00	1.1324938	.4139	9.2	.4428	BARIUM	RHODIUM					
124.00	1.1252474	.4080	9.1	.4444	BARIUM	RUTHENIUM					
124.00	1.1049286	.5881	13.4	.4956	RHODIUM	YTTRIUM					
124.00	1.0718544	.6437	15.1	.4791	RHODIUM	BORON					
124.00	1.0476324	.5755	13.8	.4962	RHODIUM	CERIUM					
124.00	1.1125064	.7428	16.8	.4574	CARBON	SILICON					
124.00	.8789213	.5503	15.7	.4920	RHODIUM	CARBON					
124.00	.8661509	.5426	15.7	.4898	RUTHENIUM	CARBON					
124.00	.6193523	.3020	12.3	.4287	SILVER	CARBON					
124.00	.4147207	.2218	13.4	.4190	GOLD	CARBON					
124.00	.3399269	.3247	24.0	.4774	MOLYBDENUM	CARBON					

118.15	1.3511245	.7932	14.8	.4570	RHODIUM	STRONTIUM					
118.15	1.3341480	.7835	14.8	.4525	RUTHENIUM	STRONTIUM					
118.15	1.2350297	.6989	14.2	.4919	RHODIUM	CALCIUM					
118.15	1.2278056	.6888	14.1	.4895	RUTHENIUM	CALCIUM					
118.15	1.2278056	.6888	14.1	.4895	RUTHENIUM	CALCIUM					
118.15	.8516139	.2471	7.3	.4956	SILVER	SILICON					
118.15	.5607167	.3935	17.6	.4988	MOLYBDENUM	PRASEODYMIUM					
118.15	.4835218	.2681	13.8	.4278	GOLD	YTTRIUM					
118.15	.3622490	.2120	14.7	.4303	PLATINUM	CERIUM					
118.15	1.2350297	.6999	14.2	.4919	RHODIUM	CALCIUM					
118.15	1.0753225	.5777	13.5	.4881	PRASEODYMIUM	RUTHENIUM					
118.15	1.0744462	.5888	13.8	.4846	PRASEODYMIUM	RHODIUM					
118.15	.9777350	.6749	17.3	.4864	RHODIUM	BORON					
118.15	.8516139	.2471	7.3	.4956	SILVER	SILICON					
118.15	.8078983	.3463	10.8	.4503	SILVER	PRASEODYMIUM					
118.15	.7889328	.5795	18.5	.4922	RHODIUM	CARBON					
118.15	.7889328	.5795	18.5	.4922	RHODIUM	CARBON					
118.15	.7880242	.5681	18.1	.4962	RUTHENIUM	CARBON					
118.15	.5930741	.3375	14.3	.4347	SILVER	CARBON					
118.15	.3824543	.2382	15.7	.4237	GOLD	CARBON					
118.15	.3018874	.3253	27.1	.4759	MOLYBDENUM	CARBON					
118.15	.2935003	.2266	19.4	.4305	SILICON	CARBON					

107.27	1.0214504	.4474	11.0	.4931	PRASEODYMIUM	SILVER					
107.27	1.0093117	.7433	18.5	.4570	RUTHENIUM	STRONTIUM					
107.27	1.0053504	.5262	13.2	.4699	PRASEODYMIUM	STRONTIUM					
107.27	.9767443	.7437	19.1	.4601	RHODIUM	STRONTIUM					
107.27	1.0093117	.7433	18.5	.4570	RUTHENIUM	STRONTIUM					
107.27	.8575356	.6524	19.1	.4884	RHODIUM	CALCIUM					
107.27	.4692197	.2389	12.8	.4674	GOLD	SAMARIUM					
107.27	.4277099	.3396	20.0	.4833	CERIUM	MOLYBDENUM					
107.27	.3007834	.2275	19.0	.4531	CADMIUM	NEODYMIUM					
107.27	1.0093117	.7433	18.5	.4570	RUTHENIUM	STRONTIUM					
107.27	1.0053504	.5262	13.2	.4699	PRASEODYMIUM	RUTHENIUM					
107.27	.9665518	.5260	13.7	.4666	PRASEODYMIUM	RHODIUM					
107.27	.8953378	.6537	18.4	.4866	RUTHENIUM	CALCIUM					
107.27	.7671481	.4110	13.5	.4978	SILVER	CERIUM					
107.27	.7363348	.5708	19.5	.4961	RUTHENIUM	YTTRIUM					
107.27	.7336285	.4545	15.3	.4823	SILVER	NEODYMIUM					
107.27	.5793081	.4641	20.1	.4624	SILVER	CARBON					
107.27	.5655386	.5389	23.9	.4884	RUTHENIUM	CARBON					
107.27	.5270848	.5315	25.3	.4907	RHODIUM	CARBON					
107.27	.3162947	.3259	25.9	.4502	PRASEODYMIUM	CARBON					
107.27	.3110537	.2687	21.7	.4292	GOLD	CARBON					
107.27	.2369437	.3282	34.8	.4716	MOLYBDENUM	CARBON					

TABLE I (continued).

MINIMUM Z ALLOWED IS 5				MINIMUM Z ALLOWED IS 5			
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L	
	(STERAD.)		(AT) (NORMAL) (INCIDENCE)	(DB) (-----) (DB + DL)			
102.21	.9014047	.7038	19.6	.4486	SILVER	STRONTIUM	
102.21	.8827989	.7206	20.5	.4583	RUTHENIUM	STRONTIUM	
102.21	.8327108	.4825	14.6	.4814	SAMARIUM	SILVER	
102.21	.8262690	.7095	21.6	.4587	RHODIUM	STRONTIUM	
102.21	.7916319	.4973	15.8	.4730	SAMARIUM	RUTHENIUM	
102.21	.7119230	.6197	21.9	.4837	RHODIUM	CALCIUM	
102.21	.4898197	.3195	16.4	.4568	CERIUM	MOLYBDENUM	
102.21	.4404322	.1707	9.7	.4711	PRASEODYMIUM	GOLD	
102.21	.3507850	.2326	16.7	.4881	CADMIUM	NEODYMIUM	
102.21	.8327108	.4825	14.6	.4814	SAMARIUM	SILVER	
102.21	.8001664	.6191	19.4	.4749	SILVER	CALCIUM	
102.21	.7916319	.4973	15.8	.4730	SAMARIUM	RUTHENIUM	
102.21	.7398200	.4839	16.4	.4725	SAMARIUM	RHODIUM	
102.21	.6777908	.5389	20.0	.4863	SILVER	YTRIUM	
102.21	.6501302	.6189	23.9	.4569	SILVER	BORON	
102.21	.5403075	.4539	21.1	.4971	SILVER	SCANDIUM	
102.21	.5241220	.5167	24.8	.4761	SILVER	CARBON	
102.21	.4852981	.5247	27.2	.4847	RUTHENIUM	CARBON	
102.21	.4313318	.5007	29.2	.4834	RHODIUM	CARBON	
102.21	.2742464	.2274	20.8	.4159	PRASEODYMIUM	CARBON	
102.21	.2679134	.2781	26.1	.4327	GOLD	CARBON	
102.21	.2421253	.2609	27.1	.4307	CERIUM	CARBON	
97.39	.9019028	.5267	14.7	.4704	SAMARIUM	SILVER	
97.39	.8852607	.5184	14.7	.4714	SAMARIUM	RUTHENIUM	
97.39	.8227817	.4953	15.1	.4727	SAMARIUM	RHODIUM	
97.39	.8011853	.7099	22.3	.4622	SILVER	STRONTIUM	
97.39	.7769757	.6989	22.6	.4596	RUTHENIUM	STRONTIUM	
97.39	.5940232	.5880	24.9	.4787	RHODIUM	CALCIUM	
97.39	.3635661	.3555	24.6	.4913	EUROPIUM	MOLYBDENUM	
97.39	.3352613	.1663	12.5	.4151	PRASEODYMIUM	ANTIMONY	
97.39	.3121428	.2997	24.1	.4657	GOLD	YTRIUM	
97.39	.8852607	.5184	14.7	.4714	SAMARIUM	RUTHENIUM	
97.39	.8227817	.4953	15.1	.4727	SAMARIUM	RHODIUM	
97.39	.8011853	.7099	22.3	.4622	SILVER	STRONTIUM	
97.39	.6867755	.6291	23.0	.4840	SILVER	CALCIUM	
97.39	.6347232	.4239	16.8	.4755	SAMARIUM	MOLYBDENUM	
97.39	.6088137	.3992	16.5	.4802	SAMARIUM	ANTIMONY	
97.39	.5962038	.3513	14.8	.4965	SAMARIUM	CADMIUM	
97.39	.4376435	.5278	30.3	.4815	SILVER	CARBON	
97.39	.4193570	.5123	30.7	.4797	RUTHENIUM	CARBON	
97.39	.3575040	.3901	27.4	.4474	SAMARIUM	CARBON	
97.39	.3560413	.4722	33.3	.4773	RHODIUM	CARBON	
97.39	.2757964	.1867	17.0	.4017	PRASEODYMIUM	CARBON	
97.39	.2222257	.2743	31.0	.4338	GOLD	CARBON	
92.79	.7149746	.3780	13.3	.4338	SAMARIUM	RUTHENIUM	
92.79	.6982898	.3925	14.1	.4275	SAMARIUM	SILVER	
92.79	.6887284	.6747	24.6	.4625	RUTHENIUM	STRONTIUM	
92.79	.6836054	.6916	25.4	.4715	SILVER	STRONTIUM	
92.79	.6836054	.6916	25.4	.4715	SILVER	STRONTIUM	
92.79	.4977878	.5572	28.1	.4748	RHODIUM	CALCIUM	
92.79	.3756774	.2961	19.8	.4799	EUROPIUM	CADMIUM	
92.79	.3419405	.3368	24.8	.4810	GADOLINIUM	MOLYBDENUM	
92.79	.2640582	.2891	27.5	.4479	GOLD	YTRIUM	
92.79	.6982898	.3925	14.1	.4275	SAMARIUM	SILVER	
92.79	.6887284	.6747	24.6	.4625	RUTHENIUM	STRONTIUM	
92.79	.6655546	.3533	13.3	.4375	SAMARIUM	RHODIUM	
92.79	.5763553	.5991	26.1	.4799	RUTHENIUM	CALCIUM	
92.79	.5639757	.2904	12.9	.4446	SAMARIUM	CADMIUM	
92.79	.5582958	.3158	14.2	.4374	SAMARIUM	MOLYBDENUM	
92.79	.5488711	.3406	15.6	.4288	SAMARIUM	ANTIMONY	
92.79	.3861755	.3204	20.8	.4142	SAMARIUM	CARBON	
92.79	.3645323	.5015	34.6	.4757	RUTHENIUM	CARBON	
92.79	.3477036	.5123	37.0	.4825	SILVER	CARBON	
92.79	.2964496	.4465	37.9	.4705	RHODIUM	CARBON	
92.79	.2411495	.1673	17.4	.3968	PRASEODYMIUM	CARBON	
92.79	.1905079	.1841	24.3	.4046	NICKEL	CARBON	
88.42	.5997285	.6249	26.2	.4740	RUTHENIUM	STRONTIUM	
88.42	.5533155	.6281	28.5	.4816	SILVER	STRONTIUM	
88.42	.5133200	.5753	28.2	.4661	RHODIUM	STRONTIUM	
88.42	.4971372	.5799	29.3	.4766	RUTHENIUM	CALCIUM	
88.42	.4486331	.5790	32.4	.4814	SILVER	CALCIUM	
88.42	.3996414	.2843	17.9	.4443	GADOLINIUM	RHODIUM	
88.42	.3409365	.1706	12.6	.4052	SAMARIUM	CADMIUM	
88.42	.2409912	.3561	37.1	.4872	MOLYBDENUM	YTRIUM	
88.42	.2198895	.2450	28.0	.4008	NICKEL	BORON	
88.42	.4971372	.5799	29.3	.4766	RUTHENIUM	CALCIUM	
88.42	.4489226	.3204	17.9	.4411	GADOLINIUM	RUTHENIUM	
88.42	.4251713	.4836	28.6	.4922	RUTHENIUM	YTRIUM	
88.42	.4211870	.6106	36.4	.4500	RUTHENIUM	BORON	
88.42	.4125051	.3220	19.6	.4368	RUTHENIUM	SILVER	
88.42	.3996414	.2843	17.9	.4443	GADOLINIUM	RHODIUM	
88.42	.3409365	.1706	12.6	.4052	SAMARIUM	CADMIUM	
88.42	.3155684	.4898	39.0	.4710	RUTHENIUM	CARBON	
88.42	.3081465	.1905	15.5	.3987	SAMARIUM	CARBON	
88.42	.2655045	.4736	44.8	.4631	SILVER	CARBON	
88.42	.2478844	.4215	42.7	.4631	RHODIUM	CARBON	
88.42	.1953643	.2443	31.4	.4176	GADOLINIUM	CARBON	
88.42	.1830924	.1947	26.7	.4055	NICKEL	CARBON	

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5							MINIMUM 2 ALLOWED IS 5						
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L	WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L
(STERAD.)			(AT) (NORMAL) (INCIDENCE)	(DB) (-----) (DE + DL)			(STERAD.)			(AT) (NORMAL) (INCIDENCE)	(DB) (-----) (DE + DL)		
84.25	.610486	.5116	20.4	.4869	TERBIUM	RUTHENIUM	76.49	.3675349	.4791	32.8	.4899	RUTHENIUM	STRONTIUM
84.25	.5593168	.4643	20.9	.4932	TERBIUM	RHODIUM	76.49	.3269112	.5331	41.0	.4666	RUTHENIUM	CALCIUM
84.25	.5472233	.4891	22.5	.4843	TERBIUM	SILVER	76.49	.3169213	.4325	34.3	.4840	RUTHENIUM	STRONTIUM
84.25	.5132090	.5722	28.0	.4808	RUTHENIUM	STRONTIUM	76.49	.3105307	.6081	49.2	.4348	RUTHENIUM	BORON
84.25	.4368943	.5171	29.7	.4730	RHOIDIUM	STRONTIUM	76.49	.2764825	.4821	43.8	.4600	RHOIDIUM	CALCIUM
84.25	.3469184	.5237	37.9	.4741	SILVER	CALCIUM	76.49	.2161374	.5212	60.6	.4318	SILVER	BORON
84.25	.2511738	.2779	27.8	.4505	DYSPROSIUM	CADIUM	76.49	.1732151	.1645	23.9	.4289	NICKEL	YTRIUM
84.25	.2351955	.1811	19.4	.4018	GADOLINIUM	ANTIMONY	76.49	.1701805	.1746	25.8	.3958	DYSPROSIUM	CARBON
84.25	.2308433	.1943	21.2	.3951	SAMARIUM	BORON	76.49	.1461331	.1725	29.7	.4397	HOLINIUM	LANTHNUM
84.25	.5593168	.4643	20.9	.4932	TERBIUM	RHODIUM	76.49	.3269112	.5331	41.0	.4666	RUTHENIUM	CALCIUM
84.25	.5472233	.4891	22.5	.4843	TERBIUM	SILVER	76.49	.3105307	.6081	49.2	.4348	RUTHENIUM	BORON
84.25	.5132090	.5722	28.0	.4808	RUTHENIUM	STRONTIUM	76.49	.2613248	.3701	35.6	.4962	RUTHENIUM	RUTHENIUM
84.25	.4794366	.4668	24.5	.4816	TERBIUM	CADIUM	76.49	.2195205	.3222	36.9	.4972	RHOIDIUM	YTRIUM
84.25	.4605827	.4394	24.0	.4879	TERBIUM	MOLYBDENUM	76.49	.2112711	.4637	55.2	.4570	RUTHENIUM	CARBON
84.25	.4305804	.5618	32.8	.4735	RUTHENIUM	CALCIUM	76.49	.1942381	.3461	44.8	.4885	RUTHENIUM	SCANDIUM
84.25	.4172559	.4917	29.6	.4668	TERBIUM	ANTIMONY	76.49	.1846959	.1934	26.3	.4457	HOLINIUM	RHOIDIUM
84.25	.2747178	.4795	43.9	.4661	RUTHENIUM	CARBON	76.49	.2112711	.4637	55.2	.4570	RUTHENIUM	CARBON
84.25	.2703111	.4379	40.7	.4518	TERBIUM	CARBON	76.49	.1701805	.3958	25.8	.4570	DYSPROSIUM	CARBON
84.25	.2165721	.1735	20.1	.3965	SAMARIUM	CARBON	76.49	.1696070	.4029	59.7	.4509	RHOIDIUM	CARBON
84.25	.2156634	.4086	47.6	.4572	RHOIDIUM	CARBON	76.49	.1618083	.4061	38.3	.4061	NICKEL	CARBON
84.25	.2136485	.1807	21.3	.3986	GADOLINIUM	CARBON	76.49	.1555600	.2373	38.6	.4084	COBALT	CARBON
84.25	.1972055	.4176	53.2	.4666	SILVER	CARBON	76.49	.1509897	.2064	34.4	.4044	COPPER	CARBON
80.27	.4341869	.5234	30.3	.4849	RUTHENIUM	STRONTIUM	72.88	.3088500	.4359	35.5	.4951	RUTHENIUM	STRONTIUM
80.27	.3743152	.5458	36.6	.4701	RUTHENIUM	CALCIUM	72.88	.2923790	.6180	53.1	.4306	RUTHENIUM	BORON
80.27	.3740326	.4740	31.8	.4784	RHOIDIUM	STRONTIUM	72.88	.2861730	.5217	45.8	.4635	RUTHENIUM	CALCIUM
80.27	.3375558	.6032	44.9	.4399	RUTHENIUM	BORON	72.88	.2727600	.3404	31.4	.4755	TRULIUM	RUTHENIUM
80.27	.3160367	.4924	39.2	.4625	RHOIDIUM	CALCIUM	72.88	.2490588	.5696	57.5	.4265	RHOIDIUM	BORON
80.27	.2457573	.5338	54.6	.4391	SILVER	BORON	72.88	.1971233	.2676	34.1	.4088	NICKEL	CALCIUM
80.27	.2218169	.2015	22.8	.4204	DYSPROSIUM	CADIUM	72.88	.1952992	.2707	34.8	.4787	TRULIUM	SILVER
80.27	.1889050	.1764	23.5	.4218	NICKEL	YTRIUM	72.88	.1547032	.1620	26.3	.4397	COBALT	YTRIUM
80.27	.1849169	.1644	22.3	.4002	TERBIUM	ANTIMONY	72.88	.1441093	.2180	38.0	.4037	COPPER	CARBON
80.27	.3743152	.5458	36.6	.4701	RUTHENIUM	CALCIUM	72.88	.2923790	.6180	53.1	.4306	RUTHENIUM	BORON
80.27	.3735558	.6032	44.9	.4399	RUTHENIUM	BORON	72.88	.2861730	.5217	45.8	.4635	RUTHENIUM	CALCIUM
80.27	.3155603	.4178	33.3	.4965	RUTHENIUM	YTRIUM	72.88	.2727600	.3404	31.4	.4755	TRULIUM	RUTHENIUM
80.27	.2901234	.4267	19.7	.4289	DYSPROSIUM	RUTHENIUM	72.88	.2366248	.3010	32.0	.4806	TRULIUM	RHOIDIUM
80.27	.2617219	.2013	19.3	.4289	DYSPROSIUM	RHODIUM	72.88	.2178788	.4143	47.8	.4864	STRONTIUM	LANTHNUM
80.27	.2433456	.2010	20.8	.4256	DYSPROSIUM	SILVER	72.88	.1952992	.2707	34.8	.4787	TRULIUM	SILVER
80.27	.2400960	.4700	49.2	.4623	RUTHENIUM	CARBON	72.88	.1865092	.4593	61.9	.4523	RUTHENIUM	CARBON
80.27	.2400960	.4700	49.2	.4623	RUTHENIUM	CARBON	72.88	.1865092	.4593	61.9	.4523	RUTHENIUM	CARBON
80.27	.1921421	.4063	53.1	.4063	RHOIDIUM	CARBON	72.88	.1551165	.2427	39.3	.4055	NICKEL	CARBON
80.27	.1782234	.1747	24.6	.3972	TERBIUM	CARBON	72.88	.1497098	.3999	67.1	.4469	RHOIDIUM	CARBON
80.27	.1705427	.1836	27.1	.3989	SAMARIUM	CARBON	72.88	.1493306	.2519	42.4	.4077	COBALT	CARBON
80.27	.1678060	.2156	32.3	.4069	NICKEL	CARBON	72.88	.1441093	.2180	38.0	.4037	COPPER	CARBON
80.27	.1642152	.2087	31.9	.4063	DYSPROSIUM	CARBON	72.88	.1263152	.2491	49.6	.4120	IRON	CARBON

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5				MINIMUM 2 ALLOWED IS 5			
WAVE-LENGTH	SOLID ANGLE (STERAD.)	R	N (NORMAL) (INCIDENCE)	GAMMA (DB + DL)	ELEMENT - E	MINIMUM 2 ALLOWED IS 5	L
57.24	.1525889	.3278	54.0	.4103	NICKEL	CALCIUM	
57.24	.1498680	.3425	57.4	.4133	COBALT	CALCIUM	
57.24	.1445212	.4629	80.5	.4487	RUTHENIUM	CALCIUM	
57.24	.1433814	.3030	53.1	.4083	COPPER	CALCIUM	
57.24	.1217258	.3353	69.2	.4047	COBALT	CARBON	
57.24	.1198178	.2828	59.3	.4051	COPPER	BARIUM	
57.24	.1088250	.2371	55.8	.4858	STRONTIUM	RUTHENIUM	
57.24	.0876223	.2169	62.2	.4340	IRON	SCANDIUM	
57.24	.0783390	.1478	47.4	.4955	CHROMIUM	YTTRIUM	
57.24	.1265298	.3223	64.0	.4027	NICKEL	CARBON	
57.24	.1263130	.3058	60.8	.4068	NICKEL	BARIUM	
57.24	.1206709	.1643	34.2	.4538	NICKEL	STRONTIUM	
57.24	.1113299	.2229	50.3	.4226	NICKEL	SCANDIUM	
57.24	.1068250	.2371	55.8	.4858	STRONTIUM	RUTHENIUM	
57.24	.1020708	.1367	33.6	.4593	NICKEL	YTTRIUM	
57.24	.0919065	.2016	55.1	.4930	STRONTIUM	RHODIUM	
57.24	.1265298	.3223	64.0	.4027	NICKEL	CARBON	
57.24	.1217258	.3353	69.2	.4047	COBALT	CARBON	
57.24	.1202329	.2980	62.3	.4013	COPPER	CARBON	
57.24	.1036869	.3354	81.3	.4085	IRON	CARBON	
57.24	.1010491	.4389	109.2	.4311	RUTHENIUM	CARBON	
57.24	.0956272	.2167	57.0	.3979	OSMIUM	CARBON	
54.54	.1449455	.3426	59.4	.4103	NICKEL	CALCIUM	
54.54	.1421725	.3573	63.2	.4133	COBALT	CALCIUM	
54.54	.1370099	.3205	58.8	.4086	COPPER	CALCIUM	
54.54	.1263856	.3620	72.0	.4187	IRON	CALCIUM	
54.54	.1176078	.3560	76.1	.4042	COBALT	CARBON	
54.54	.1147804	.2979	65.2	.4060	COPPER	BARIUM	
54.54	.0915565	.1633	44.8	.4755	IRON	STRONTIUM	
54.54	.0799937	.1563	49.1	.4069	OSMIUM	SCANDIUM	
54.54	.0693653	.1408	51.0	.4982	YTTRIUM	CHROMIUM	
54.54	.1221185	.3422	70.4	.4022	NICKEL	CARBON	
54.54	.1207066	.3186	66.3	.4074	NICKEL	BARIUM	
54.54	.1095639	.1628	37.4	.4568	NICKEL	STRONTIUM	
54.54	.1063112	.2311	55.6	.4238	NICKEL	SCANDIUM	
54.54	.0919783	.1314	35.9	.4660	NICKEL	YTTRIUM	
54.54	.0859248	.2108	61.7	.4844	STRONTIUM	RUTHENIUM	
54.54	.0846626	.1533	45.5	.4434	NICKEL	BISMUTH	
54.54	.1221185	.3422	70.4	.4022	NICKEL	CARBON	
54.54	.1176078	.3560	76.1	.4042	COBALT	CARBON	
54.54	.1163008	.3199	69.1	.4011	COPPER	CARBON	
54.54	.1005154	.3570	89.3	.4078	IRON	CARBON	
54.54	.0931491	.2238	60.4	.3969	OSMIUM	CARBON	
54.54	.0925842	.3741	101.6	.4128	MANGANESE	CARBON	
51.96	.1374447	.3570	65.3	.4103	NICKEL	CALCIUM	
51.96	.1345214	.3716	69.4	.4134	COBALT	CALCIUM	
51.96	.1299606	.3367	65.1	.4089	COPPER	CALCIUM	
51.96	.1194205	.3760	79.1	.4188	IRON	CALCIUM	
51.96	.1138985	.3773	83.3	.4037	COBALT	CARBON	
51.96	.1089936	.3100	71.5	.4073	COPPER	BARIUM	
51.96	.0818711	.1603	49.2	.4781	IRON	STRONTIUM	
51.96	.0774574	.1623	52.7	.4054	OSMIUM	SCANDIUM	
51.96	.0663391	.1444	54.7	.4032	RHENIUM	LANTHANUM	
51.96	.1182199	.3627	77.1	.4017	NICKEL	CARBON	
51.96	.1149478	.3292	72.0	.4085	NICKEL	BARIUM	
51.96	.1013737	.2470	61.2	.4256	NICKEL	SCANDIUM	
51.96	.0995354	.1615	40.8	.4605	NICKEL	STRONTIUM	
51.96	.082892	.1259	38.4	.4710	NICKEL	YTTRIUM	
51.96	.0808504	.1533	47.7	.4494	NICKEL	BISMUTH	
51.96	.0796785	.1835	57.9	.4322	NICKEL	TELLURIUM	
51.96	.1182199	.3627	77.1	.4017	NICKEL	CARBON	
51.96	.1138985	.3773	83.3	.4037	COBALT	CARBON	
51.96	.1128868	.3417	76.5	.4009	COPPER	CARBON	
51.96	.0977997	.3795	97.5	.4072	IRON	CARBON	
51.96	.0905125	.3982	110.6	.4120	MANGANESE	CARBON	
51.96	.0905014	.2305	64.0	.3961	OSMIUM	CARBON	
49.51	.1307309	.3729	71.7	.4104	NICKEL	CALCIUM	
49.51	.1276692	.3874	76.3	.4135	COBALT	CALCIUM	
49.51	.1232844	.3535	72.1	.4093	COPPER	CALCIUM	
49.51	.1158438	.3870	84.0	.4013	NICKEL	CARBON	
49.51	.1117363	.4024	90.5	.4032	COBALT	CARBON	
49.51	.1031845	.3186	77.6	.4095	COPPER	BARIUM	
49.51	.0759166	.2545	84.3	.4355	IRON	SCANDIUM	
49.51	.0672346	.1624	60.7	.4855	MANGANESE	STRONTIUM	
49.51	.0640699	.1430	56.1	.4053	OSMIUM	LANTHANUM	
49.51	.1158438	.3870	84.0	.4013	NICKEL	CARBON	
49.51	.1094335	.3372	77.4	.4107	NICKEL	BARIUM	
49.51	.0969887	.2607	67.6	.4269	NICKEL	SCANDIUM	
49.51	.0902632	.1601	44.6	.4846	NICKEL	STRONTIUM	
49.51	.0766603	.1494	49.0	.4582	NICKEL	BISMUTH	
49.51	.0752382	.1884	62.9	.4350	NICKEL	TELLURIUM	
49.51	.0743154	.1735	58.7	.4413	NICKEL	MAGNESIUM	
49.51	.1158438	.3870	84.0	.4013	NICKEL	CARBON	
49.51	.1117363	.4024	90.5	.4032	COBALT	CARBON	
49.51	.1095174	.3666	84.1	.4006	COPPER	CARBON	
49.51	.0966251	.4064	105.7	.4067	IRON	CARBON	
49.51	.0898495	.4282	119.2	.4112	MANGANESE	CARBON	
49.51	.0896666	.4401	123.4	.4135	CHROMIUM	CARBON	

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5				MINIMUM 2 ALLOWED IS 5			
WAVE-LENGTH	SOLID ANGLE	R	((AT) (NORMAL) (INCIDENCE)	GAMMA	ELEMENT - B	ELEMENT - L	
(STERAD.)	(STERAD.)			(DB + DL)			
47.18	.1239217	.3882	78.7	.4105	NICKEL	CALCIUM	
47.18	.1208611	.4027	83.7	.4136	COBALT	CALCIUM	
47.18	.1168963	.3702	79.6	.4096	COPPER	CALCIUM	
47.18	.1153135	.4148	90.4	.4010	NICKEL	CALCIUM	
47.18	.1116143	.4315	97.2	.4028	COBALT	CALCIUM	
47.18	.0970016	.3216	83.3	.4130	COPPER	CALCIUM	
47.18	.0734785	.1749	59.8	.4042	OSMIUM	SCANDIUM	
47.18	.0646417	.1532	59.5	.4866	IRON	STRONTIUM	
47.18	.0608108	.1379	57.0	.4069	RHENIUM	LANTHANUM	
47.18	.1153135	.4148	90.4	.4010	NICKEL	CALCIUM	
47.18	.1031049	.3388	82.6	.4140	NICKEL	BARIUM	
47.18	.0924175	.2743	74.6	.4270	NICKEL	SCANDIUM	
47.18	.0812373	.1579	48.9	.4686	NICKEL	STRONTIUM	
47.18	.0711742	.1866	65.9	.4405	NICKEL	MAGNESIUM	
47.18	.0705807	.1925	68.5	.4378	NICKEL	TELLURIUM	
47.18	.0668517	.1319	49.6	.4708	NICKEL	BISMUTH	
47.18	.1153135	.4148	90.4	.4010	NICKEL	CALCIUM	
47.18	.1116143	.4315	97.2	.4028	COBALT	CALCIUM	
47.18	.1089744	.3956	91.2	.4004	COPPER	CALCIUM	
47.18	.0975702	.4381	112.8	.4062	IRON	CALCIUM	
47.18	.0914605	.4596	126.3	.4105	MANGANESE	CALCIUM	
47.18	.0913411	.4741	130.5	.4127	CHROMIUM	CALCIUM	
44.95	.1226485	.4576	93.8	.4006	NICKEL	CALCIUM	
44.95	.1195897	.4764	100.1	.4024	COBALT	CALCIUM	
44.95	.1179073	.4049	86.3	.4106	NICKEL	CALCIUM	
44.95	.1158960	.4397	95.4	.4002	COPPER	CALCIUM	
44.95	.1147640	.4192	91.8	.4138	COBALT	CALCIUM	
44.95	.0906558	.3211	89.0	.4174	COPPER	BARIUM	
44.95	.0728794	.1819	62.7	.4036	RHENIUM	SCANDIUM	
44.95	.0597438	.1317	55.4	.4122	OSMIUM	MAGNESIUM	
44.95	.0562291	.1474	65.9	.4910	IRON	STRONTIUM	
44.95	.1179073	.4049	86.3	.4106	NICKEL	CALCIUM	
44.95	.0968237	.3377	87.7	.4183	NICKEL	BARIUM	
44.95	.0884266	.2887	82.0	.4290	NICKEL	SCANDIUM	
44.95	.0721916	.1543	53.7	.4729	NICKEL	STRONTIUM	
44.95	.0681476	.1997	73.6	.4414	NICKEL	MAGNESIUM	
44.95	.0662155	.1967	74.7	.4408	NICKEL	TELLURIUM	
44.95	.0607033	.1940	80.3	.4357	NICKEL	LANTHANUM	
44.95	.1195897	.4764	100.1	.4024	COBALT	CALCIUM	
44.95	.1158960	.4397	95.4	.4002	COPPER	CALCIUM	
44.95	.1069728	.4883	114.7	.4057	IRON	CALCIUM	
44.95	.1021631	.5288	130.1	.4120	CHROMIUM	CALCIUM	
44.95	.1019223	.5131	126.5	.4098	MANGANESE	CALCIUM	
44.95	.0924616	.2647	71.9	.3940	RHENIUM	CALCIUM	

MINIMUM 2 ALLOWED IS 5				MINIMUM 2 ALLOWED IS 5			
WAVE-LENGTH	SOLID ANGLE	R	((AT) (NORMAL) (INCIDENCE)	GAMMA	ELEMENT - B	ELEMENT - L	
(STERAD.)	(STERAD.)			(DB + DL)			
42.83	.1124902	.4229	94.5	.4108	NICKEL	CALCIUM	
42.83	.1093994	.4372	100.4	.4140	COBALT	CALCIUM	
42.83	.1045191	.4029	96.9	.4101	COPPER	CALCIUM	
42.83	.0968666	.4409	114.4	.4195	IRON	CALCIUM	
42.83	.0862075	.3424	99.8	.4276	COBALT	BARIUM	
42.83	.0778504	.2868	92.6	.4280	COPPER	SCANDIUM	
42.83	.0642170	.1566	61.3	.4906	CARBON	IRON	
42.83	.0602197	.1433	59.8	.4099	RHENIUM	MAGNESIUM	
42.83	.0575206	.1363	59.6	.4115	OSMIUM	TELLURIUM	
42.83	.0904452	.3354	93.2	.4231	NICKEL	BARIUM	
42.83	.0848480	.3057	90.6	.4291	NICKEL	SCANDIUM	
42.83	.0775310	.1557	50.5	.4904	NICKEL	CARBON	
42.83	.0651236	.2137	82.5	.4410	NICKEL	MAGNESIUM	
42.83	.0650893	.1559	60.2	.4734	NICKEL	STRONTIUM	
42.83	.0642170	.1566	61.3	.4906	CARBON	IRON	
42.83	.0623839	.2034	82.0	.4431	NICKEL	TELLURIUM	
42.83	.0775310	.1557	50.5	.4904	NICKEL	CARBON	
42.83	.0745941	.1602	54.0	.4983	COBALT	CARBON	
42.83	.0710004	.1436	50.8	.4886	COPPER	CARBON	
42.83	.0642170	.1566	61.3	.4906	CARBON	IRON	
42.83	.0597655	.1632	68.6	.4783	CARBON	MANGANESE	
42.83	.0593950	.1698	71.8	.4741	CARBON	CHROMIUM	
40.81	.1075902	.4413	103.1	.4110	NICKEL	CALCIUM	
40.81	.1044716	.4554	109.5	.4142	COBALT	CALCIUM	
40.81	.0993976	.4197	106.1	.4103	COPPER	CALCIUM	
40.81	.0926070	.4592	124.6	.4197	IRON	CALCIUM	
40.81	.0797918	.3390	106.8	.4326	COBALT	BARIUM	
40.81	.0741790	.3022	102.4	.4280	COPPER	SCANDIUM	
40.81	.0586456	.1528	65.5	.4095	RHENIUM	MAGNESIUM	
40.81	.0553202	.1407	63.9	.4113	OSMIUM	TELLURIUM	
40.81	.0509603	.1368	67.5	.4051	IRIDIUM	TITANIUM	
40.81	.0840964	.3335	99.7	.4277	NICKEL	BARIUM	
40.81	.0814644	.3232	99.7	.4292	NICKEL	SCANDIUM	
40.81	.0620260	.2273	92.1	.4417	NICKEL	MAGNESIUM	
40.81	.0595564	.1597	67.4	.4749	NICKEL	STRONTIUM	
40.81	.0589013	.2108	90.0	.4453	NICKEL	TELLURIUM	
40.81	.0551787	.1510	68.8	.4070	RHENIUM	TITANIUM	
40.81	.0529305	.1334	63.3	.4129	RHENIUM	ANTIMONY	
40.81	.0485797	.1217	62.9	.4889	NICKEL	CARBON	
40.81	.0450006	.1217	68.0	.4968	COBALT	CARBON	
40.81	.0432707	.1091	63.4	.4870	COPPER	CARBON	
40.81	.0408708	.0715	44.0	.4423	RHENIUM	CARBON	
40.81	.0396518	.0695	44.1	.4421	OSMIUM	CARBON	
40.81	.0355625	.1107	78.2	.4921	CARBON	IRON	

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5				MINIMUM 2 ALLOWED IS 5			
WAVE-LENGTH	SOLID ANGLE	R	(AT) (NORMAL) (INCIDENCE)	GAMMA (DB + DL)	ELEMENT - B	ELEMENT - L	
(STRAD.)	(STRAD.)						
32.05	.0799121	.4595	144.5	.4302	NICKEL	SCANDIUM	
32.05	.0764881	.4669	153.4	.4352	COBALT	SCANDIUM	
32.05	.0720859	.4300	149.9	.4280	COPPER	SCANDIUM	
32.05	.0664786	.4619	174.6	.4436	IRON	SCANDIUM	
32.05	.0531909	.2068	97.7	.4081	OSMIUM	BARIUM	
32.05	.0490957	.2344	120.0	.4873	COBALT	CALCIUM	
32.05	.0490824	.2028	103.8	.4080	RHENIUM	MAGNESIUM	
32.05	.0468729	.1867	100.1	.4047	IRIDIUM	TITANIUM	
32.05	.0391804	.2190	140.5	.4587	COPPER	CADMIUM	
32.05	.0570220	.3409	150.3	.4461	NICKEL	BARIUM	
32.05	.0530572	.2349	111.3	.4811	NICKEL	CALCIUM	
32.05	.0494015	.1976	100.5	.4067	OSMIUM	MAGNESIUM	
32.05	.0490578	.1953	100.1	.4072	OSMIUM	TITANIUM	
32.05	.0462347	.1646	89.5	.4128	OSMIUM	TELLURIUM	
32.05	.0457506	.1576	86.6	.4140	OSMIUM	CADMIUM	
32.05	.0440715	.1571	89.6	.4121	OSMIUM	ANTIMONY	
32.05	.0341722	.1037	76.2	.4260	OSMIUM	CARBON	
32.05	.0335350	.1049	78.6	.4285	RHENIUM	CARBON	
32.05	.0325533	.0981	75.7	.4246	IRIDIUM	CARBON	
32.05	.0272213	.0853	78.7	.4246	PLATINUM	CARBON	
32.05	.0271405	.1418	131.3	.4824	NICKEL	CARBON	
32.05	.0259255	.0881	85.4	.4314	TUNGSTEN	CARBON	
30.54	.0551698	.2079	94.7	.4845	SCANDIUM	NICKEL	
30.54	.0527379	.3466	165.2	.4482	NICKEL	BARIUM	
30.54	.0519893	.2107	101.8	.4783	SCANDIUM	COBALT	
30.54	.0512485	.2882	141.4	.4655	NICKEL	CADMIUM	
30.54	.0511876	.2130	104.6	.4085	OSMIUM	BARIUM	
30.54	.0488500	.2184	111.3	.4087	RHENIUM	TITANIUM	
30.54	.0470132	.2859	152.8	.4714	COBALT	CADMIUM	
30.54	.0458716	.2000	109.6	.4057	IRIDIUM	MAGNESIUM	
30.54	.0412017	.2107	128.5	.4784	COPPER	CALCIUM	
30.54	.0527379	.3466	165.2	.4482	NICKEL	BARIUM	
30.54	.0519893	.2107	101.8	.4783	SCANDIUM	COBALT	
30.54	.0512485	.2882	141.4	.4655	NICKEL	CADMIUM	
30.54	.0496427	.2118	107.2	.4073	OSMIUM	TITANIUM	
30.54	.0493906	.1855	94.9	.4886	SCANDIUM	COPPER	
30.54	.0483114	.2110	109.7	.4063	OSMIUM	MAGNESIUM	
30.54	.0469979	.2367	126.6	.4825	NICKEL	CALCIUM	
30.54	.0340806	.1151	84.9	.4236	OSMIUM	CARBON	
30.54	.0329146	.1152	87.9	.4262	RHENIUM	CARBON	
30.54	.0322579	.1085	84.6	.4218	IRIDIUM	CARBON	
30.54	.0279322	.0968	87.1	.4223	PLATINUM	CARBON	
30.54	.0252611	.1518	151.0	.4812	NICKEL	CARBON	
30.54	.0251691	.0956	95.5	.4279	TUNGSTEN	CARBON	
32.05	.0694395	.3687	133.4	.4685	NICKEL	CADMIUM	
29.10	.0655674	.3717	142.5	.4748	COBALT	CADMIUM	
29.10	.0620567	.3377	136.8	.4639	COPPER	CADMIUM	
29.10	.0572705	.2119	93.0	.4183	OSMIUM	CADMIUM	
29.10	.0506640	.2312	114.7	.4084	OSMIUM	TITANIUM	
29.10	.0475491	.2226	117.7	.4103	RHENIUM	BARIUM	
29.10	.0439018	.2102	120.3	.4063	IRIDIUM	MAGNESIUM	
29.10	.0383846	.2358	154.4	.4910	COBALT	CALCIUM	
29.10	.0369182	.1597	108.7	.4098	PLATINUM	TELLURIUM	
29.10	.0530644	.3818	180.8	.4487	NICKEL	TITANIUM	
29.10	.0487238	.3528	182.0	.4510	NICKEL	BARIUM	
29.10	.0462551	.2218	120.5	.4069	OSMIUM	MAGNESIUM	
29.10	.0440157	.1830	104.5	.4135	OSMIUM	TELLURIUM	
29.10	.0425248	.1767	104.4	.4133	OSMIUM	ANTIMONY	
29.10	.0423525	.2396	142.2	.4848	NICKEL	CALCIUM	
29.10	.0375374	.1714	114.8	.4087	OSMIUM	VANADIUM	
29.10	.0331022	.1250	94.9	.4222	OSMIUM	CARBON	
29.10	.0317888	.1248	98.7	.4239	RHENIUM	CARBON	
29.10	.0313537	.1180	94.6	.4201	IRIDIUM	CARBON	
29.10	.0275638	.1067	97.3	.4204	PLATINUM	CARBON	
29.10	.0248306	.1044	105.7	.4252	TUNGSTEN	CARBON	
29.10	.0235299	.1620	173.0	.4801	NICKEL	CARBON	
27.73	.0762676	.4878	160.7	.4489	NICKEL	TITANIUM	
27.73	.0728004	.4935	170.4	.4552	COBALT	TITANIUM	
27.73	.0685806	.4533	166.1	.4445	COPPER	TITANIUM	
27.73	.0637393	.4887	192.7	.4652	IRON	TITANIUM	
27.73	.0453537	.2219	123.0	.4109	OSMIUM	BARIUM	
27.73	.0448876	.1675	93.8	.4359	CADMIUM	COBALT	
27.73	.0425534	.2357	139.2	.4069	RHENIUM	MAGNESIUM	
27.73	.0400989	.1812	113.6	.4122	IRIDIUM	TELLURIUM	
27.73	.0353970	.1643	116.6	.4122	PLATINUM	ANTIMONY	
27.73	.0466005	.1624	87.6	.4411	CADMIUM	NICKEL	
27.73	.0453537	.2219	123.0	.4109	OSMIUM	BARIUM	
27.73	.0448876	.1675	93.8	.4359	CADMIUM	COBALT	
27.73	.0437140	.2320	133.4	.4058	OSMIUM	MAGNESIUM	
27.73	.0426011	.1449	85.5	.4454	CADMIUM	COPPER	
27.73	.0423162	.1913	113.6	.4140	OSMIUM	TELLURIUM	
27.73	.0413691	.1864	113.3	.4142	OSMIUM	ANTIMONY	
27.73	.0316747	.1342	106.5	.4200	OSMIUM	CARBON	
27.73	.0302920	.1334	110.7	.4225	RHENIUM	CARBON	
27.73	.0301707	.1270	105.8	.4187	IRIDIUM	CARBON	
27.73	.0270402	.1169	108.6	.4180	PLATINUM	CARBON	
27.73	.0249028	.1153	116.3	.4223	TUNGSTEN	CARBON	
27.73	.0248715	.1185	119.7	.4248	CADMIUM	CARBON	

TABLE I (continued).

MINIMUM Z ALLOWED IS 5													
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L	WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L
	(STERAD.)	((AT)) (NORMAL) (INCIDENCE)	((AT)) (NORMAL) (INCIDENCE)	((DB) (-----) (DB + DL)				(STERAD.)		((AT)) (NORMAL) (INCIDENCE)	((DB) (-----) (DB + DL)		
26.42	.0423369	.2242	133.1	.4106	OSMIUM	BARIUM	23.99	.0564598	.4408	196.2	.4734	NICKEL	ANTIMONY
26.42	.0415840	.3685	222.7	.4541	NICKEL	BARIUM	23.99	.0523463	.4402	211.3	.4789	COBALT	ANTIMONY
26.42	.0412450	.2274	138.6	.4120	RENIUM	BARIUM	23.99	.0513142	.4060	198.9	.4675	COPPER	ANTIMONY
26.42	.0411603	.2395	146.3	.4044	OSMIUM	MAGNESIUM	23.99	.0482410	.2469	128.6	.4176	OSMIUM	ANTIMONY
26.42	.0399567	.2430	152.9	.4055	RENIUM	MAGNESIUM	23.99	.0415855	.2263	136.7	.4152	OSMIUM	TELLURIUM
26.42	.0398849	.3225	203.2	.4658	NICKEL	TELLURIUM	23.99	.0374395	.2373	159.3	.4112	RENIUM	BARIUM
26.42	.0387328	.1873	121.5	.4123	IRIDIUM	ANTIMONY	23.99	.0363297	.2483	171.8	.4014	IRIDIUM	MAGNESIUM
26.42	.0382699	.1801	138.6	.4078	PLATINUM	VANADIUM	23.99	.0334539	.1948	146.4	.4423	VANADIUM	COBALT
26.42	.0305991	.1411	115.9	.4262	TUNGSTEN	CALCIUM	23.99	.0283673	.1615	143.1	.4243	TUNGSTEN	CALCIUM
26.42	.0411603	.2395	146.3	.4044	OSMIUM	MAGNESIUM	23.99	.0425719	.3857	227.7	.4703	NICKEL	TELLURIUM
26.42	.0408719	.1994	122.6	.4131	OSMIUM	TELLURIUM	23.99	.0386205	.2347	152.7	.4098	OSMIUM	BARIUM
26.42	.0407076	.1968	121.5	.4140	OSMIUM	ANTIMONY	23.99	.0379810	.2593	171.6	.4017	OSMIUM	MAGNESIUM
26.42	.0372052	.1985	134.1	.4092	OSMIUM	VANADIUM	23.99	.0358624	.1937	135.7	.4472	VANADIUM	NICKEL
26.42	.0362387	.1536	106.6	.4238	OSMIUM	CALCIUM	23.99	.0335293	.1710	128.2	.4196	OSMIUM	CALCIUM
26.42	.0335990	.1755	131.2	.4106	OSMIUM	SILICON	23.99	.0334539	.1948	146.4	.4423	VANADIUM	COBALT
26.42	.0332319	.1767	133.7	.4104	OSMIUM	BORON	23.99	.0329778	.1722	131.3	.4523	VANADIUM	COPPER
26.42	.0303012	.1423	118.1	.4186	OSMIUM	CARBON	23.99	.0290724	.1647	142.4	.4140	OSMIUM	CARBON
26.42	.0290201	.1359	117.7	.4160	IRIDIUM	CARBON	23.99	.0277776	.1572	142.2	.4132	IRIDIUM	CARBON
26.42	.0289828	.1416	123.2	.4195	RENIUM	CARBON	23.99	.0276378	.1634	148.6	.4161	RENIUM	CARBON
26.42	.0263413	.1271	121.3	.4167	PLATINUM	CARBON	23.99	.0241352	.1457	151.8	.4142	PLATINUM	CARBON
26.42	.0248949	.1279	129.1	.4208	TUNGSTEN	CARBON	23.99	.0237683	.1519	160.6	.4181	TUNGSTEN	CARBON
26.42	.0215209	.1115	130.2	.4181	GOLD	CARBON	23.99	.0204609	.1321	162.3	.4147	GOLD	CARBON

25.17	.0436511	.3616	208.2	.4699	NICKEL	ANTIMONY	22.85	.0495940	.4446	225.3	.4738	NICKEL	TELLURIUM
25.17	.0420250	.2139	127.9	.4140	OSMIUM	ANTIMONY	22.85	.0457640	.2572	141.2	.4165	OSMIUM	TELLURIUM
25.17	.0410238	.2166	132.7	.4159	RENIUM	ANTIMONY	22.85	.0454704	.4114	227.4	.4678	COPPER	TELLURIUM
25.17	.0405145	.2104	130.5	.4133	OSMIUM	TELLURIUM	22.85	.0452689	.4404	244.5	.4792	COBALT	TELLURIUM
25.17	.0405145	.2104	130.5	.4133	OSMIUM	TELLURIUM	22.85	.0376760	.2462	164.2	.4097	OSMIUM	BARIUM
25.17	.0390173	.2315	149.1	.4115	RENIUM	BARIUM	22.85	.0358840	.2793	195.6	.4018	RENIUM	MAGNESIUM
25.17	.0382912	.2123	139.4	.4100	IRIDIUM	VANADIUM	22.85	.0311889	.1752	141.2	.4168	IRIDIUM	CALCIUM
25.17	.0345632	.2296	167.0	.4032	PLATINUM	MAGNESIUM	22.85	.0258606	.2002	195.9	.4118	TUNGSTEN	SILICON
25.17	.0294809	.1513	129.0	.4245	TUNGSTEN	CALCIUM	22.85	.0253346	.1876	186.1	.4061	PLATINUM	BORON
25.17	.0405145	.2104	130.5	.4133	OSMIUM	TELLURIUM	22.85	.0376760	.2462	164.2	.4097	OSMIUM	BARIUM
25.17	.0401726	.2287	143.1	.4101	OSMIUM	BARIUM	22.85	.0371256	.2751	186.2	.4008	OSMIUM	MAGNESIUM
25.17	.0400918	.2224	139.4	.4107	OSMIUM	VANADIUM	22.85	.0330445	.1846	140.4	.4196	OSMIUM	CALCIUM
25.17	.0393012	.2485	158.9	.4030	OSMIUM	MAGNESIUM	22.85	.0314908	.2117	168.9	.4105	OSMIUM	SILICON
25.17	.0345444	.1612	117.3	.4212	OSMIUM	CALCIUM	22.85	.0311735	.2149	173.3	.4089	OSMIUM	BORON
25.17	.0325124	.1851	143.1	.4102	OSMIUM	SILICON	22.85	.0305408	.2099	172.7	.4096	OSMIUM	ALUMINUM
25.17	.0321791	.1874	146.4	.4087	OSMIUM	BORON	22.85	.0305143	.1714	141.2	.4195	OSMIUM	STRONTIUM
25.17	.0294869	.1527	130.1	.4157	OSMIUM	CARBON	22.85	.0289252	.1799	156.3	.4137	OSMIUM	CARBON
25.17	.0282800	.1458	129.6	.4147	IRIDIUM	CARBON	22.85	.0275031	.1790	163.5	.4159	RENIUM	CARBON
25.17	.0280513	.1514	135.6	.4180	RENIUM	CARBON	22.85	.0274571	.1708	156.3	.4128	IRIDIUM	CARBON
25.17	.0253963	.1368	135.4	.4161	PLATINUM	CARBON	22.85	.0231925	.1536	166.5	.4121	PLATINUM	CARBON
25.17	.0243904	.1400	144.3	.4187	TUNGSTEN	CARBON	22.85	.0231546	.1652	179.3	.4173	TUNGSTEN	CARBON
25.17	.0210228	.1216	145.3	.4168	GOLD	CARBON	22.85	.0198129	.1429	181.3	.4143	GOLD	CARBON

TABLE I (continued).

MINIMUM Z ALLOWED IS 5										MINIMUM Z ALLOWED IS 5									
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - E	L	(AT) (NORMAL) (INCIDENCE)	(DE) (-----) (DE + DL)	(STERAD.)	WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - E	L	(AT) (NORMAL) (INCIDENCE)	(DE) (-----) (DE + DL)	(STERAD.)
17.95	.0307230	.3061	250.4	.4084	OSMIUM	BARIUM				16.30	.0310602	.3564	288.4	.4084	OSMIUM	BARIUM			
17.95	.0304401	.3159	260.9	.4102	RENIUM	BARIUM				16.30	.0306222	.3663	300.6	.4102	RENIUM	BARIUM			
17.95	.0292380	.3430	294.8	.3974	OSMIUM	MAGNESIUM				16.30	.0296084	.3400	288.6	.4075	IRIDIUM	BARIUM			
17.95	.0288131	.3551	309.7	.3982	RENIUM	MAGNESIUM				16.30	.0267173	.3542	333.2	.4126	TUNGSTEN	BARIUM			
17.95	.0288131	.3551	309.7	.3982	RENIUM	MAGNESIUM				16.30	.0260049	.3899	376.9	.3974	RENIUM	MAGNESIUM			
17.95	.0251966	.2349	234.3	.4175	IRIDIUM	CALCIUM				16.30	.0238666	.2685	282.8	.4169	IRIDIUM	CALCIUM			
17.95	.0228027	.2248	247.8	.4159	PLATINUM	IRON				16.30	.0205684	.2356	287.9	.4187	PLATINUM	LANTHNUM			
17.95	.0210579	.2715	324.0	.4102	TUNGSTEN	SILICON				16.30	.0192230	.3063	400.4	.4086	TUNGSTEN	SILICON			
17.95	.0183358	.2388	327.4	.4052	GOLD	BORON				16.30	.0168273	.2659	397.2	.4030	GOLD	BORON			
17.95	.0292380	.3430	294.8	.3974	OSMIUM	MAGNESIUM				16.30	.0266751	.3788	356.9	.3966	OSMIUM	MAGNESIUM			
17.95	.0269949	.2473	230.2	.4199	OSMIUM	CALCIUM				16.30	.0250503	.2824	283.3	.4182	OSMIUM	CALCIUM			
17.95	.0264184	.2468	234.8	.4188	OSMIUM	IRON				16.30	.0243716	.2672	275.5	.4218	OSMIUM	LANTHNUM			
17.95	.0257562	.2817	274.9	.4065	OSMIUM	SILICON				16.30	.0237753	.3183	336.5	.4051	OSMIUM	SILICON			
17.95	.0254497	.2873	283.7	.4044	OSMIUM	BORON				16.30	.0235443	.2578	275.2	.4216	OSMIUM	COBALT			
17.95	.0251764	.2297	229.3	.4200	OSMIUM	STRONTIUM				16.30	.0234420	.3244	347.8	.4030	OSMIUM	BORON			
17.95	.0250475	.2815	282.4	.4052	OSMIUM	ALUMINUM				16.30	.0234117	.2609	280.1	.4216	OSMIUM	STRONTIUM			
17.95	.0242053	.2490	258.6	.4132	OSMIUM	CARBON				16.30	.0224897	.2859	319.5	.4112	OSMIUM	CARBON			
17.95	.0235955	.2545	271.0	.4153	RENIUM	CARBON				16.30	.0216892	.2905	336.6	.4132	RENIUM	CARBON			
17.95	.0226170	.2358	262.0	.4127	IRIDIUM	CARBON				16.30	.0214935	.2720	318.1	.4102	IRIDIUM	CARBON			
17.95	.0208597	.2263	272.6	.4114	PLATINUM	CARBON				16.30	.0190384	.2521	332.8	.4102	PLATINUM	CARBON			
17.95	.0194695	.2358	304.3	.4163	TUNGSTEN	CARBON				16.30	.0178957	.2696	378.6	.4158	TUNGSTEN	CARBON			
17.95	.0171412	.2030	297.7	.4115	GOLD	CARBON				16.30	.0158949	.2291	362.3	.4113	GOLD	CARBON			
17.10	.0302662	.3269	271.5	.4084	OSMIUM	BARIUM				15.53	.0253216	.3965	393.5	.3962	OSMIUM	MAGNESIUM			
17.10	.0297984	.3359	283.3	.4102	RENIUM	BARIUM				15.53	.0251727	.2953	294.8	.4219	OSMIUM	LANTHNUM			
17.10	.0286611	.3099	271.8	.4075	IRIDIUM	BARIUM				15.53	.0246237	.4079	416.3	.3970	RENIUM	MAGNESIUM			
17.10	.0280642	.3616	323.9	.3970	OSMIUM	MAGNESIUM				15.53	.0245276	.3008	308.2	.4247	RENIUM	LANTHNUM			
17.10	.0274461	.3728	341.4	.3978	RENIUM	MAGNESIUM				15.53	.0245276	.3008	308.2	.4247	RENIUM	LANTHNUM			
17.10	.0247235	.2507	254.8	.4177	IRIDIUM	CALCIUM				15.53	.0229231	.2867	314.4	.4160	IRIDIUM	CALCIUM			
17.10	.0211599	.2696	320.2	.4054	PLATINUM	SILICON				15.53	.0196512	.3017	385.9	.4036	PLATINUM	SILICON			
17.10	.0198613	.2951	373.5	.4069	TUNGSTEN	BORON				15.53	.0179706	.2615	365.7	.4254	TUNGSTEN	STRONTIUM			
17.10	.0171701	.2459	359.9	.4050	GOLD	ALUMINUM				15.53	.0163956	.2851	437.0	.4022	GOLD	BORON			
17.10	.0280642	.3616	323.9	.3970	OSMIUM	MAGNESIUM				15.53	.0251727	.2953	294.8	.4219	OSMIUM	LANTHNUM			
17.10	.0261405	.2653	255.1	.4191	OSMIUM	CALCIUM				15.53	.0239752	.3006	315.1	.4173	OSMIUM	CALCIUM			
17.10	.0248813	.3008	303.9	.4058	OSMIUM	SILICON				15.53	.0226839	.3366	373.0	.4045	OSMIUM	SILICON			
17.10	.0245561	.3065	313.7	.4037	OSMIUM	BORON				15.53	.0224336	.2777	311.1	.4210	OSMIUM	STRONTIUM			
17.10	.0244887	.2478	254.3	.4200	OSMIUM	LANTHNUM				15.53	.0223426	.3431	385.9	.4023	OSMIUM	BORON			
17.10	.0244030	.2459	253.3	.4200	OSMIUM	STRONTIUM				15.53	.0220631	.3368	383.6	.4032	OSMIUM	ALUMINUM			
17.10	.0241932	.3005	312.2	.4045	OSMIUM	ALUMINUM				15.53	.0220063	.2604	297.4	.4245	OSMIUM	CERIUM			
17.10	.0234544	.2679	287.1	.4122	OSMIUM	CARBON				15.53	.0215269	.3048	355.9	.4103	OSMIUM	CARBON			
17.10	.0226854	.2724	301.8	.4143	RENIUM	CARBON				15.53	.0207164	.3095	375.5	.4122	RENIUM	CARBON			
17.10	.0222636	.2534	286.0	.4111	IRIDIUM	CARBON				15.53	.0206382	.2908	354.2	.4092	IRIDIUM	CARBON			
17.10	.0198189	.2379	301.7	.4118	PLATINUM	CARBON				15.53	.0185623	.2715	367.6	.4091	PLATINUM	CARBON			
17.10	.0187162	.2520	338.5	.4169	TUNGSTEN	CARBON				15.53	.0170843	.2880	423.7	.4148	TUNGSTEN	CARBON			
17.10	.0164164	.2155	329.9	.4112	GOLD	CARBON				15.53	.0155789	.2484	400.7	.4101	GOLD	CARBON			

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5													
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L	WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L
(STERAD.)	(STERAD.)	(AT) (NORMAL) (INCIDENCE)	(DB) (-----) (DB + DL)				(STERAD.)	(STERAD.)	(AT) (NORMAL) (INCIDENCE)	(DB) (-----) (DB + DL)			
14.79	.0239419	.4140	434.6	.3959	OSMIUM	MAGNESIUM	14.79	.0239419	.4140	434.6	.3959	OSMIUM	COPPER
14.79	.0232361	.4256	460.4	.3966	RHENIUM	MAGNESIUM	14.79	.0232361	.4256	460.4	.3966	RHENIUM	COPPER
14.79	.0230492	.3966	432.4	.3955	IRIDIUM	MAGNESIUM	14.79	.0230492	.3966	432.4	.3955	IRIDIUM	COPPER
14.79	.0228446	.3188	350.7	.4165	OSMIUM	CALCIUM	14.79	.0228446	.3188	350.7	.4165	OSMIUM	MAGNESIUM
14.79	.0221389	.3243	368.1	.4190	RHENIUM	CALCIUM	14.79	.0221389	.3243	368.1	.4190	RHENIUM	MAGNESIUM
14.79	.0217667	.2751	317.6	.4247	IRIDIUM	CERIUM	14.79	.0217667	.2751	317.6	.4247	IRIDIUM	PRASEODYMIUM
14.79	.0188333	.3207	427.9	.4031	PLATINUM	SILICON	14.79	.0188333	.3207	427.9	.4031	PLATINUM	CALCIUM
14.79	.0171004	.2770	407.2	.4266	TUNGSTEN	STRONTIUM	14.79	.0171004	.2770	407.2	.4266	TUNGSTEN	SILICON
14.79	.0157407	.3042	485.8	.4016	GOLD	BORON	14.79	.0157407	.3042	485.8	.4016	GOLD	STRONTIUM
14.79	.0228446	.3188	350.7	.4165	OSMIUM	CALCIUM	14.79	.0228446	.3188	350.7	.4165	OSMIUM	MAGNESIUM
14.79	.0227450	.2881	318.3	.4263	OSMIUM	CERIUM	14.79	.0227450	.2881	318.3	.4263	OSMIUM	PRASEODYMIUM
14.79	.0215455	.3547	413.8	.4039	OSMIUM	SILICON	14.79	.0215455	.3547	413.8	.4039	OSMIUM	CALCIUM
14.79	.0214053	.2946	345.9	.4203	OSMIUM	STRONTIUM	14.79	.0214053	.2946	345.9	.4203	OSMIUM	STRONTIUM
14.79	.0211983	.3615	428.6	.4016	OSMIUM	BORON	14.79	.0211983	.3615	428.6	.4016	OSMIUM	SILICON
14.79	.0209613	.3552	425.8	.4026	OSMIUM	ALUMINUM	14.79	.0209613	.3552	425.8	.4026	OSMIUM	BORON
14.79	.0205061	.3236	396.6	.4094	OSMIUM	CARBON	14.79	.0205061	.3236	396.6	.4094	OSMIUM	ALUMINUM
14.79	.0205061	.3236	396.6	.4094	OSMIUM	CARBON	14.79	.0205061	.3236	396.6	.4094	OSMIUM	MAGNESIUM
14.79	.0197031	.3286	419.1	.4113	RHENIUM	CARBON	14.79	.0197031	.3286	419.1	.4113	RHENIUM	PRASEODYMIUM
14.79	.0196993	.3094	394.7	.4084	IRIDIUM	CARBON	14.79	.0196993	.3094	394.7	.4084	IRIDIUM	CARBON
14.79	.0178453	.2909	409.7	.4083	PLATINUM	CARBON	14.79	.0178453	.2909	409.7	.4083	PLATINUM	CARBON
14.79	.0162336	.3066	474.6	.4138	TUNGSTEN	CARBON	14.79	.0162336	.3066	474.6	.4138	TUNGSTEN	CARBON
14.79	.0150288	.2674	447.2	.4093	GOLD	CARBON	14.79	.0150288	.2674	447.2	.4093	GOLD	CARBON
14.10	.0296954	.3629	307.2	.4264	OSMIUM	CERIUM	14.10	.0296954	.3629	307.2	.4264	OSMIUM	NEODYMIUM
14.10	.0292814	.3713	318.7	.4296	RHENIUM	CERIUM	14.10	.0292814	.3713	318.7	.4296	RHENIUM	NEODYMIUM
14.10	.0284530	.3485	307.8	.4247	IRIDIUM	CERIUM	14.10	.0284530	.3485	307.8	.4247	IRIDIUM	NEODYMIUM
14.10	.0263103	.3331	318.2	.4246	PLATINUM	CERIUM	14.10	.0263103	.3331	318.2	.4246	PLATINUM	MAGNESIUM
14.10	.0218569	.4428	509.1	.3963	RHENIUM	MAGNESIUM	14.10	.0218569	.4428	509.1	.3963	RHENIUM	MAGNESIUM
14.10	.0208229	.3226	389.3	.4145	IRIDIUM	CALCIUM	14.10	.0208229	.3226	389.3	.4145	IRIDIUM	CALCIUM
14.10	.0179393	.3390	474.9	.4026	PLATINUM	SILICON	14.10	.0179393	.3390	474.9	.4026	PLATINUM	STRONTIUM
14.10	.0162021	.2931	454.6	.4261	TUNGSTEN	STRONTIUM	14.10	.0162021	.2931	454.6	.4261	TUNGSTEN	SILICON
14.10	.0150081	.3226	540.2	.4010	GOLD	BORON	14.10	.0150081	.3226	540.2	.4010	GOLD	BORON
14.10	.0225788	.4312	479.9	.3956	OSMIUM	MAGNESIUM	14.10	.0225788	.4312	479.9	.3956	OSMIUM	MAGNESIUM
14.10	.0216955	.3368	390.2	.4157	OSMIUM	CALCIUM	14.10	.0216955	.3368	390.2	.4157	OSMIUM	CALCIUM
14.10	.0204014	.3726	459.1	.4034	OSMIUM	SILICON	14.10	.0204014	.3726	459.1	.4034	OSMIUM	STRONTIUM
14.10	.0203615	.3115	384.5	.4198	OSMIUM	STRONTIUM	14.10	.0203615	.3115	384.5	.4198	OSMIUM	SILICON
14.10	.0200501	.3797	476.0	.4010	OSMIUM	BORON	14.10	.0200501	.3797	476.0	.4010	OSMIUM	BORON
14.10	.0198543	.3733	472.6	.4020	OSMIUM	ALUMINUM	14.10	.0198543	.3733	472.6	.4020	OSMIUM	ALUMINUM
14.10	.0194678	.3422	441.8	.4085	OSMIUM	CARBON	14.10	.0194678	.3422	441.8	.4085	OSMIUM	CARBON
14.10	.0194678	.3422	441.8	.4085	OSMIUM	CARBON	14.10	.0194678	.3422	441.8	.4085	OSMIUM	CARBON
14.10	.0187261	.3277	439.7	.4076	IRIDIUM	CARBON	14.10	.0187261	.3277	439.7	.4076	IRIDIUM	CARBON
14.10	.0186633	.3472	467.6	.4104	RHENIUM	CARBON	14.10	.0186633	.3472	467.6	.4104	RHENIUM	CARBON
14.10	.0170444	.3097	456.6	.4075	PLATINUM	CARBON	14.10	.0170444	.3097	456.6	.4075	PLATINUM	CARBON
14.10	.0153525	.3247	531.5	.4129	TUNGSTEN	CARBON	14.10	.0153525	.3247	531.5	.4129	TUNGSTEN	CARBON
14.10	.0143913	.2858	499.0	.4084	GOLD	CARBON	14.10	.0143913	.2858	499.0	.4084	GOLD	CARBON

TABLE I (continued).

MINIMUM Z ALLOWED IS 5										MINIMUM Z ALLOWED IS 5									
WAVE- LENGTH	SOLID ANGLE (STERAD.)	R	N	GAMMA		ELEMENT - B	ELEMENT - L	WAVE- LENGTH	SOLID ANGLE (STERAD.)	R	N	GAMMA		ELEMENT - B	ELEMENT - L				
				(AT) (NORMAL) (INCIDENCE)	(DB) (-----) (DB + DL)							(AT) (NORMAL) (INCIDENCE)	(DB) (-----) (DB + DL)						
12.19	.0197399	.3727	474.5	.4236	.4236	OSMIUM	ZINC	11.07	.0193857	.4191	543.4	.4263	.4263	OSMIUM	EUROPIUM				
12.19	.0190767	.3772	497.0	.4266	.4266	RHENIUM	ZINC	11.07	.0188435	.4248	566.6	.4294	.4294	RHENIUM	EUROPIUM				
12.19	.0190392	.3591	474.0	.4220	.4220	IRIDIUM	ZINC	11.07	.0187709	.4059	543.5	.4246	.4246	IRIDIUM	EUROPIUM				
12.19	.0187346	.4835	648.6	.3948	.3948	OSMIUM	MAGNESIUM	11.07	.0174653	.3908	562.3	.4245	.4245	PLATINUM	EUROPIUM				
12.19	.0181765	.4663	644.7	.3945	.3945	IRIDIUM	MAGNESIUM	11.07	.0159648	.5023	790.8	.3941	.3941	IRIDIUM	MAGNESIUM				
12.19	.0176206	.3970	566.2	.4161	.4161	RHENIUM	CALCIUM	11.07	.0155210	.4349	704.3	.4149	.4149	RHENIUM	CALCIUM				
12.19	.0153025	.3335	547.8	.4168	.4168	PLATINUM	STRONTIUM	11.07	.0136706	.3702	680.6	.4161	.4161	PLATINUM	STRONTIUM				
12.19	.0134875	.4126	768.8	.4051	.4051	TUNGSTEN	SILICON	11.07	.0116812	.4468	961.2	.4042	.4042	TUNGSTEN	SILICON				
12.19	.0127529	.3771	743.2	.3993	.3993	GOLD	BORON	11.07	.0113084	.4154	923.3	.3985	.3985	GOLD	BORON				
12.19	.0187346	.4835	648.6	.3948	.3948	OSMIUM	MAGNESIUM	11.07	.0163880	.5188	795.6	.3944	.3944	OSMIUM	MAGNESIUM				
12.19	.0183205	.3921	537.9	.4138	.4138	OSMIUM	CALCIUM	11.07	.0161421	.4298	669.2	.4126	.4126	OSMIUM	CALCIUM				
12.19	.0172994	.3643	529.3	.4183	.4183	OSMIUM	STRONTIUM	11.07	.0153135	.4005	657.3	.4175	.4175	OSMIUM	STRONTIUM				
12.19	.0170857	.4273	628.6	.4020	.4020	OSMIUM	SILICON	11.07	.0149750	.4638	778.4	.4012	.4012	OSMIUM	SILICON				
12.19	.0167207	.4348	653.6	.3995	.3995	OSMIUM	BORON	11.07	.0146133	.4658	801.1	.3997	.3997	OSMIUM	ALUMINUM				
12.19	.0166490	.4288	647.3	.4005	.4005	OSMIUM	ALUMINUM	11.07	.0146026	.4715	811.5	.3986	.3986	OSMIUM	BORON				
12.19	.0164021	.3992	611.8	.4063	.4063	OSMIUM	CARBON	11.07	.0144090	.4374	763.0	.4051	.4051	OSMIUM	CARBON				
12.19	.0164021	.3992	611.8	.4063	.4063	OSMIUM	CARBON	11.07	.0144090	.4374	763.0	.4051	.4051	OSMIUM	CARBON				
12.19	.0158706	.3844	608.7	.4054	.4054	IRIDIUM	CARBON	11.07	.0139972	.4229	759.3	.4043	.4043	IRIDIUM	CARBON				
12.19	.0156492	.4039	648.7	.4081	.4081	RHENIUM	CARBON	11.07	.0137457	.4425	809.0	.4067	.4067	RHENIUM	CARBON				
12.19	.0154541	.3665	633.4	.4054	.4054	PLATINUM	CARBON	11.07	.0128919	.4053	790.2	.4042	.4042	PLATINUM	CARBON				
12.19	.0127623	.3793	747.0	.4104	.4104	TUNGSTEN	CARBON	11.07	.0110778	.4151	941.8	.4089	.4089	TUNGSTEN	CARBON				
12.19	.0123723	.3414	693.6	.4061	.4061	GOLD	CARBON	11.07	.0110456	.3807	866.2	.4049	.4049	GOLD	CARBON				
11.62	.0199430	.3657	460.9	.4361	.4361	OSMIUM	SAMARIUM	10.55	.0166908	.3756	565.5	.4404	.4404	OSMIUM	GADOLINIUM				
11.62	.0193418	.3701	480.9	.4398	.4398	RHENIUM	SAMARIUM	10.55	.0161877	.3636	564.6	.4383	.4383	IRIDIUM	GADOLINIUM				
11.62	.0192645	.3530	460.5	.4341	.4341	IRIDIUM	SAMARIUM	10.55	.0161295	.3791	590.7	.4443	.4443	RHENIUM	GADOLINIUM				
11.62	.0178283	.3377	476.0	.4340	.4340	PLATINUM	SAMARIUM	10.55	.0152900	.5361	881.1	.3942	.3942	OSMIUM	MAGNESIUM				
11.62	.0170681	.4848	713.9	.3943	.3943	IRIDIUM	MAGNESIUM	10.55	.0149272	.5200	875.6	.3939	.3939	IRIDIUM	MAGNESIUM				
11.62	.0165803	.4165	631.3	.4155	.4155	RHENIUM	CALCIUM	10.55	.0144872	.4532	786.3	.4142	.4142	RHENIUM	CALCIUM				
11.62	.0145010	.3522	610.5	.4164	.4164	PLATINUM	STRONTIUM	10.55	.0128462	.3882	759.4	.4157	.4157	PLATINUM	STRONTIUM				
11.62	.0125979	.3293	657.0	.4334	.4334	TUNGSTEN	EUROPIUM	10.55	.0108913	.4267	984.8	.4007	.4007	GOLD	SILICON				
11.62	.0123404	.3898	793.8	.4014	.4014	GOLD	SILICON	10.55	.0104907	.4652	1114.5	.4019	.4019	TUNGSTEN	ALUMINUM				
11.62	.0175526	.5016	718.2	.3946	.3946	OSMIUM	MAGNESIUM	10.55	.0152900	.5361	881.1	.3942	.3942	OSMIUM	MAGNESIUM				
11.62	.0172410	.4115	599.9	.4132	.4132	OSMIUM	CALCIUM	10.55	.0150637	.4480	747.4	.4121	.4121	OSMIUM	CALCIUM				
11.62	.0163163	.3828	589.7	.4179	.4179	OSMIUM	STRONTIUM	10.55	.0143269	.4181	733.4	.4171	.4171	OSMIUM	STRONTIUM				
11.62	.0162097	.3543	549.3	.4261	.4261	OSMIUM	EUROPIUM	10.55	.0139421	.4812	867.5	.4008	.4008	OSMIUM	SILICON				
11.62	.0160343	.4461	699.3	.4016	.4016	OSMIUM	SILICON	10.55	.0137567	.4014	733.4	.4194	.4194	OSMIUM	GERMANIUM				
11.62	.0156644	.4538	728.1	.3990	.3990	OSMIUM	BORON	10.55	.0136222	.4836	892.3	.3994	.3994	OSMIUM	ALUMINUM				
11.62	.0156338	.4478	719.9	.4001	.4001	OSMIUM	ALUMINUM	10.55	.0135680	.4889	905.7	.3982	.3982	OSMIUM	BORON				
11.62	.0154133	.4189	683.0	.4057	.4057	OSMIUM	CARBON	10.55	.0134231	.4557	853.2	.4045	.4045	OSMIUM	CARBON				
11.62	.0149465	.4042	679.6	.4049	.4049	IRIDIUM	CARBON	10.55	.0130678	.4414	848.9	.4037	.4037	IRIDIUM	CARBON				
11.62	.0147053	.4237	724.2	.4074	.4074	RHENIUM	CARBON	10.55	.0128084	.4610	904.5	.4061	.4061	RHENIUM	CARBON				
11.62	.0137306	.3864	707.3	.4048	.4048	PLATINUM	CARBON	10.55	.0120618	.4240	883.5	.4037	.4037	PLATINUM	CARBON				
11.62	.0119273	.3978	838.3	.4096	.4096	TUNGSTEN	CARBON	10.55	.0103725	.3998	968.8	.4043	.4043	GOLD	CARBON				
11.62	.0117295	.3616	774.8	.4055	.4055	GOLD	CARBON	10.55	.0102450	.4320	1059.7	.4082	.4082	TUNGSTEN	CARBON				

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5				MINIMUM 2 ALLOWED IS 5			
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - B	ELEMENT - L	
	(STERAD.)		(AT) (NORMAL) (INCIDENCE)	(DE) (-----) (DE + DL)			
10.05	.0159578	.3832	603.5	.4450	OSMIUM	TERBIUM	
10.05	.0155012	.3716	602.5	.4428	IRIDIUM	TERBIUM	
10.05	.0154426	.3869	629.6	.4491	RHENIUM	TERBIUM	
10.05	.0144310	.3570	621.8	.4426	PLATINUM	TERBIUM	
10.05	.0139714	.5378	967.4	.3937	IRIDIUM	MAGNESIUM	
10.05	.0134753	.4708	878.0	.4137	RHENIUM	CALCIUM	
10.05	.0130359	.4056	847.0	.4153	PLATINUM	STRONTIUM	
10.05	.0101838	.4445	1097.1	.4003	GOLD	SILICON	
10.05	.0096738	.4808	1249.1	.4015	TUNGSTEN	ALUMINUM	
10.05	.0142880	.5534	973.5	.3940	OSMIUM	MAGNESIUM	
10.05	.0140061	.4653	834.9	.4115	OSMIUM	CALCIUM	
10.05	.0133594	.4350	818.4	.4167	OSMIUM	STRONTIUM	
10.05	.0129391	.4979	967.0	.4005	OSMIUM	SILICON	
10.05	.0126640	.5007	993.8	.3990	OSMIUM	ALUMINUM	
10.05	.0125629	.5054	1011.1	.3978	OSMIUM	BORON	
10.05	.0124583	.4731	954.4	.4040	OSMIUM	CARBON	
10.05	.0124583	.4731	954.4	.4040	OSMIUM	CARBON	
10.05	.0121478	.4589	949.5	.4032	IRIDIUM	CARBON	
10.05	.0118927	.4786	1011.4	.4055	RHENIUM	CARBON	
10.05	.0112476	.4420	987.7	.4031	PLATINUM	CARBON	
10.05	.0097007	.4182	1083.4	.4038	GOLD	CARBON	
10.05	.0094230	.4476	1193.9	.4075	TUNGSTEN	CARBON	
9.58	.0165575	.4127	626.4	.4479	OSMIUM	DYSPROSIUM	
9.58	.0161371	.4180	651.0	.4522	RHENIUM	DYSPROSIUM	
9.58	.0161267	.4014	625.5	.4456	IRIDIUM	DYSPROSIUM	
9.58	.0151270	.3879	644.5	.4455	PLATINUM	DYSPROSIUM	
9.58	.0136672	.5652	1039.3	.3936	IRIDIUM	MAGNESIUM	
9.58	.0125079	.4883	981.2	.4132	RHENIUM	CALCIUM	
9.58	.0112513	.4233	945.6	.4149	PLATINUM	STRONTIUM	
9.58	.0095135	.3702	978.1	.4230	GOLD	ARSENIC	
9.58	.0091040	.5034	1389.7	.4039	RHODIUM	SILICON	
9.58	.0139413	.5802	1045.9	.3938	OSMIUM	MAGNESIUM	
9.58	.0129803	.4822	933.7	.4110	OSMIUM	CALCIUM	
9.58	.0124188	.4519	914.5	.4163	OSMIUM	STRONTIUM	
9.58	.0121923	.4226	871.1	.4234	OSMIUM	ARSENIC	
9.58	.0119721	.5141	1079.3	.4002	OSMIUM	SILICON	
9.58	.0117489	.5176	1107.2	.3987	OSMIUM	ALUMINUM	
9.58	.0115940	.5214	1130.3	.3974	OSMIUM	BORON	
9.58	.0115225	.4901	1069.1	.4034	OSMIUM	CARBON	
9.58	.0112657	.4764	1062.9	.4027	IRIDIUM	CARBON	
9.58	.0110164	.4964	1132.4	.4049	RHENIUM	CARBON	
9.58	.0104604	.4600	1105.1	.4026	PLATINUM	CARBON	
9.58	.0090500	.4365	1212.3	.4032	GOLD	CARBON	
9.58	.0086222	.4628	1349.1	.4069	TUNGSTEN	CARBON	
9.13	.0119757	.4984	1045.9	.4106	OSMIUM	OSMIUM	
9.13	.0119091	.4044	853.5	.4374	OSMIUM	MAGNESIUM	
9.13	.0117153	.4857	1042.1	.4095	IRIDIUM	CALCIUM	
9.13	.0116307	.3936	850.5	.4354	IRIDIUM	MAGNESIUM	
9.13	.0116307	.3936	850.5	.4354	IRIDIUM	MAGNESIUM	
9.13	.0110646	.4734	1075.4	.4185	RHENIUM	STRONTIUM	
9.13	.0101163	.5008	1244.2	.3992	PLATINUM	SILICON	
9.13	.0087091	.4837	1395.7	.3983	GOLD	ALUMINUM	
9.13	.0081599	.5329	1641.4	.3999	RHODIUM	BORON	
9.13	.0119091	.4044	853.5	.4374	OSMIUM	MAGNESIUM	
9.13	.0114963	.4682	1023.5	.4159	OSMIUM	STRONTIUM	
9.13	.0110323	.5287	1206.7	.3998	OSMIUM	SILICON	
9.13	.0108717	.5339	1234.3	.3984	OSMIUM	ALUMINUM	
9.13	.0106517	.5366	1266.0	.3971	OSMIUM	BORON	
9.13	.0106065	.5063	1199.8	.4029	OSMIUM	CARBON	
9.13	.0096496	.3869	1007.8	.4289	OSMIUM	SCANDIUM	
9.13	.0106065	.5063	1199.8	.4029	OSMIUM	CARBON	
9.13	.0103949	.4931	1192.1	.4022	IRIDIUM	CARBON	
9.13	.0101583	.5134	1270.3	.4044	RHENIUM	CARBON	
9.13	.0096910	.4773	1237.9	.4021	PLATINUM	CARBON	
9.13	.0084131	.4544	1357.5	.4027	GOLD	CARBON	
9.13	.0080764	.4930	1540.3	.4076	RHODIUM	CARBON	
8.70	.0109931	.5136	1174.1	.4101	OSMIUM	CALCIUM	
8.70	.0107822	.5015	1168.9	.4091	IRIDIUM	CALCIUM	
8.70	.0107591	.4161	971.9	.4366	OSMIUM	MAGNESIUM	
8.70	.0106232	.5211	1232.7	.4122	RHENIUM	CALCIUM	
8.70	.0105370	.4057	967.7	.4346	IRIDIUM	MAGNESIUM	
8.70	.0102088	.4896	1205.4	.4181	RHENIUM	STRONTIUM	
8.70	.0093415	.5193	1390.7	.3989	PLATINUM	SILICON	
8.70	.0081498	.5023	1549.1	.3980	GOLD	ALUMINUM	
8.70	.0076099	.5538	1828.9	.3996	RHODIUM	BORON	
8.70	.0107591	.4161	971.9	.4366	OSMIUM	MAGNESIUM	
8.70	.0105930	.4837	1147.7	.4155	OSMIUM	STRONTIUM	
8.70	.0101208	.5444	1351.9	.3995	OSMIUM	SILICON	
8.70	.0100538	.5502	1375.4	.3981	OSMIUM	ALUMINUM	
8.70	.0097364	.5507	1421.5	.3967	OSMIUM	BORON	
8.70	.0097113	.5215	1349.7	.4024	OSMIUM	CARBON	
8.70	.0089046	.4030	1137.5	.4281	OSMIUM	SCANDIUM	
8.70	.0097113	.5215	1349.7	.4024	OSMIUM	CARBON	
8.70	.0095435	.5088	1339.8	.4017	IRIDIUM	CARBON	
8.70	.0093092	.5293	1429.0	.4038	RHENIUM	CARBON	
8.70	.0089328	.4938	1389.4	.4016	PLATINUM	CARBON	
8.70	.007854	.4715	1522.2	.4022	GOLD	CARBON	
8.70	.0075580	.5170	1719.3	.4071	RHODIUM	CARBON	

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5													
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - E	ELEMENT - L	WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - E	ELEMENT - L
(STERAD.)	(DE + DL)	(INCIDENCE)	(NORMAL)	(DE + DL)	(INCIDENCE)	(NORMAL)	(STERAD.)	(DE + DL)	(INCIDENCE)	(NORMAL)	(DE + DL)	(INCIDENCE)	(NORMAL)
8.29	.0100319	.5273	1321.1	.4096	OSMIUM	CALCIUM	7.52	.0081169	.5502	1703.5	.4085	OSMIUM	CALCIUM
8.29	.0098685	.5159	1313.8	.4086	IRIDIUM	CALCIUM	7.52	.0080710	.5410	1684.7	.4076	IRIDIUM	CALCIUM
8.29	.0097545	.4283	1103.5	.4359	OSMIUM	MAGNESIUM	7.52	.0079420	.5212	1649.2	.4145	OSMIUM	STRONTIUM
8.29	.0097083	.5355	1386.3	.4118	RENIUM	CALCIUM	7.52	.0078998	.5601	1781.9	.4106	RENIUM	STRONTIUM
8.29	.0095833	.4185	1097.6	.4340	IRIDIUM	MAGNESIUM	7.52	.0078957	.5125	1631.5	.4133	IRIDIUM	STRONTIUM
8.29	.0093715	.5045	1353.0	.4178	RENIUM	STRONTIUM	7.52	.0076096	.4547	1501.7	.4386	RENIUM	MAGNESIUM
8.29	.0086949	.5413	1564.6	.3973	PLATINUM	ALUMINUM	7.52	.0071849	.5605	1960.5	.3980	PLATINUM	SILICON
8.29	.0075810	.5125	1699.0	.3990	GOLD	SILICON	7.52	.0061258	.5813	2384.8	.4059	RHODIUM	CARBON
8.29	.0072228	.3690	1283.8	.4575	RHODIUM	YTTERBIUM	7.52	.0060750	.6297	2605.1	.3998	RUTHENIUM	BORON
8.29	.0097545	.4283	1103.5	.4359	OSMIUM	MAGNESIUM	7.52	.0079420	.5212	1649.2	.4145	OSMIUM	STRONTIUM
8.29	.0097068	.4979	1289.1	.4152	OSMIUM	STRONTIUM	7.52	.0078495	.4490	1437.6	.4346	OSMIUM	MAGNESIUM
8.29	.0093311	.5670	1527.1	.3978	OSMIUM	STRONTIUM	7.52	.0075160	.5802	1940.2	.3986	OSMIUM	SILICON
8.29	.0092380	.5577	1517.4	.3992	OSMIUM	SILICON	7.52	.0070967	.5562	1969.6	.4009	OSMIUM	CARBON
8.29	.0091693	.3825	1048.4	.4477	OSMIUM	YTTERBIUM	7.52	.0070943	.5826	2063.9	.3958	OSMIUM	BORON
8.29	.0088480	.5632	1599.9	.3964	OSMIUM	BORON	7.52	.0068462	.3659	1343.1	.4521	OSMIUM	ALUMINUM
8.29	.0088370	.5351	1521.8	.4019	OSMIUM	CARBON	7.52	.0066151	.4407	1674.3	.4259	OSMIUM	SCANDIUM
8.29	.0088370	.5351	1521.8	.4019	OSMIUM	CARBON	7.52	.0070967	.5562	1969.6	.4009	OSMIUM	CARBON
8.29	.0087113	.5230	1508.8	.4012	IRIDIUM	CARBON	7.52	.0070761	.5465	1941.1	.4003	IRIDIUM	CARBON
8.29	.0084820	.5436	1610.7	.4033	RENIUM	CARBON	7.52	.0068493	.5665	2078.7	.4023	RENIUM	CARBON
8.29	.0081977	.5091	1560.9	.4012	PLATINUM	CARBON	7.52	.0067692	.5363	1991.0	.4003	PLATINUM	CARBON
8.29	.0071785	.4877	1707.6	.4017	GOLD	CARBON	7.52	.0061258	.5813	2384.8	.4059	RHODIUM	CARBON
8.29	.0070577	.5384	1917.2	.4067	RHODIUM	CARBON	7.52	.0061018	.5954	2452.4	.4076	RUTHENIUM	CARBON
7.89	.0090790	.5401	1495.0	.4091	OSMIUM	CALCIUM	7.17	.0071587	.5494	1928.8	.4071	IRIDIUM	CALCIUM
7.89	.0089678	.5295	1483.8	.4081	IRIDIUM	CALCIUM	7.17	.0071370	.5567	1960.3	.4080	OSMIUM	CALCIUM
7.89	.0088288	.5107	1453.7	.4148	OSMIUM	STRONTIUM	7.17	.0070638	.5219	1856.9	.4129	IRIDIUM	STRONTIUM
7.89	.0088016	.4398	1255.9	.4352	OSMIUM	MAGNESIUM	7.17	.0070425	.5286	1886.3	.4141	OSMIUM	STRONTIUM
7.89	.0087176	.5006	1443.2	.4136	IRIDIUM	STRONTIUM	7.17	.0070425	.5286	1886.3	.4141	OSMIUM	STRONTIUM
7.89	.0084562	.4444	1314.7	.4392	RENIUM	MAGNESIUM	7.17	.0067291	.4623	1726.6	.4379	RENIUM	MAGNESIUM
7.89	.0079854	.3596	1311.9	.4501	PLATINUM	ALUMINUM	7.17	.0065273	.5733	2207.3	.3977	PLATINUM	SILICON
7.89	.0070154	.5891	2110.4	.4028	RHODIUM	SILICON	7.17	.0056940	.3145	1388.3	.4971	RHODIUM	TANTALUM
7.89	.0066319	.5319	2015.8	.3960	GOLD	BORON	7.17	.0056588	.6162	2736.7	.4072	RUTHENIUM	CARBON
7.89	.0088288	.5107	1453.7	.4148	OSMIUM	STRONTIUM	7.17	.0070638	.5219	1856.9	.4129	IRIDIUM	STRONTIUM
7.89	.0088016	.4398	1255.9	.4352	OSMIUM	MAGNESIUM	7.17	.0069069	.4492	1634.7	.4321	IRIDIUM	MAGNESIUM
7.89	.0085693	.3793	1112.3	.4538	OSMIUM	ALUMINUM	7.17	.0067122	.5799	2171.5	.3978	IRIDIUM	SILICON
7.89	.0083738	.5700	1710.9	.3989	OSMIUM	SILICON	7.17	.0063027	.2935	1170.2	.4777	IRIDIUM	TANTALUM
7.89	.0079726	.5743	1810.3	.3961	OSMIUM	BORON	7.17	.0062504	.5788	2327.4	.3951	IRIDIUM	BORON
7.89	.0079708	.5470	1724.8	.4014	OSMIUM	CARBON	7.17	.0062468	.5538	2328.1	.3989	IRIDIUM	CARBON
7.89	.0074017	.4306	1462.3	.4266	OSMIUM	SCANDIUM	7.17	.0058555	.3602	1545.9	.4503	IRIDIUM	ALUMINUM
7.89	.0079708	.5470	1724.8	.4014	OSMIUM	CARBON	7.17	.0062468	.5538	2328.1	.3999	IRIDIUM	CARBON
7.89	.0078915	.5358	1706.5	.4008	IRIDIUM	CARBON	7.17	.0062064	.5614	2273.5	.4005	OSMIUM	CARBON
7.89	.0076622	.5582	1824.3	.4028	RENIUM	CARBON	7.17	.0060628	.5467	2266.2	.3989	PLATINUM	CARBON
7.89	.0074786	.5235	1759.4	.4007	PLATINUM	CARBON	7.17	.0060382	.5738	2388.4	.4018	RENIUM	CARBON
7.89	.0065871	.5034	1920.6	.4012	GOLD	CARBON	7.17	.0056855	.6017	2659.6	.4055	RHODIUM	CARBON
7.89	.0065850	.5602	2138.1	.4063	RHODIUM	CARBON	7.17	.0056588	.6162	2736.7	.4072	RUTHENIUM	CARBON

TABLE I (continued).

MINIMUM 2 ALLOWED IS 5				MINIMUM 2 ALLOWED IS 5			
WAVE-LENGTH	SOLID ANGLE	R	N	GAMMA	ELEMENT - E	ELEMENT - L	
	(STERAD.)		((AT (NORMAL) (INCIDENCE)))	((DB () (-----)))			
6.83	.0062662	.5858	2349.6	.4239	RHODIUM	STRONTIUM	
6.83	.0062650	.5987	2401.6	.4271	RUTHENIUM	STRONTIUM	
6.83	.0062405	.6154	2478.5	.4153	RHODIUM	CALCIUM	
6.83	.0062383	.6290	2534.3	.4180	RUTHENIUM	CALCIUM	
6.83	.0062383	.6290	2534.3	.4180	RUTHENIUM	CALCIUM	
6.83	.0061491	.5948	2431.2	.3975	IRIDIUM	SILICON	
6.83	.0059175	.4502	1911.9	.4313	PLATINUM	MAGNESIUM	
6.83	.0052356	.5778	2773.5	.4014	RHENIUM	CARBON	
6.83	.0052304	.5844	2807.9	.3952	OSMIUM	BORON	
6.83	.0062405	.6154	2478.5	.4153	RHODIUM	CALCIUM	
6.83	.0061491	.5948	2431.2	.3975	IRIDIUM	SILICON	
6.83	.0059671	.5014	2111.9	.4479	RHODIUM	MAGNESIUM	
6.83	.0053661	.5799	2716.1	.3949	IRIDIUM	BORON	
6.83	.0053594	.5553	2604.0	.3995	IRIDIUM	CARBON	
6.83	.0049949	.4428	2228.2	.4230	IRIDIUM	SCANDIUM	
6.83	.0049336	.3578	1822.9	.4496	IRIDIUM	ALUMINIUM	
6.83	.0053594	.5553	2604.0	.3995	IRIDIUM	CARBON	
6.83	.0053379	.5537	2607.2	.3995	PLATINUM	CARBON	
6.83	.0052673	.6216	2966.1	.4051	RHODIUM	CARBON	
6.83	.0052356	.5778	2773.5	.4014	RHENIUM	CARBON	
6.83	.0052314	.6360	3055.4	.4069	RUTHENIUM	CARBON	
6.83	.0052251	.5588	2688.0	.4001	OSMIUM	CARBON	
6.51	.0058632	.6060	2597.7	.4241	RHODIUM	STRONTIUM	
6.51	.0058488	.6185	2657.7	.4274	RUTHENIUM	STRONTIUM	
6.51	.0057770	.6348	2761.8	.4150	RHODIUM	CALCIUM	
6.51	.0057603	.6481	2827.6	.4177	RUTHENIUM	CALCIUM	
6.51	.0057603	.6481	2827.6	.4177	RUTHENIUM	CALCIUM	
6.51	.0050698	.3898	1932.4	.4524	PLATINUM	SILICON	
6.51	.0047439	.4425	2344.1	.4320	GOLD	MAGNESIUM	
6.51	.0042117	.5621	3354.5	.3946	IRIDIUM	BORON	
6.51	.0040400	.5382	3347.9	.3997	OSMIUM	CARBON	
6.51	.0057770	.6348	2761.8	.4150	RHODIUM	CALCIUM	
6.51	.0055531	.5224	2364.6	.4476	RHODIUM	MAGNESIUM	
6.51	.0055245	.4562	2075.5	.4689	RHODIUM	SILICON	
6.51	.0048639	.6408	3311.2	.4048	RHODIUM	CARBON	
6.51	.0048148	.6697	3495.6	.3980	RHODIUM	BORON	
6.51	.0045706	.5117	2813.9	.4370	RHODIUM	SCANDIUM	
6.51	.0044398	.4155	2352.2	.4657	RHODIUM	ALUMINIUM	
6.51	.0048639	.6408	3311.2	.4048	RHODIUM	CARBON	
6.51	.0048167	.6548	3416.5	.4065	RUTHENIUM	CARBON	
6.51	.0045543	.5542	3058.5	.3991	PLATINUM	CARBON	
6.51	.0042621	.5471	3226.0	.3995	GOLD	CARBON	
6.51	.0041917	.5372	3220.8	.3991	IRIDIUM	CARBON	
6.51	.0040400	.5382	3347.9	.3997	OSMIUM	CARBON	
6.20	.0053353	.6535	3078.4	.4147	RHODIUM	CALCIUM	
6.20	.0053071	.6664	3155.7	.4174	RUTHENIUM	CALCIUM	
6.20	.0051582	.5431	2646.4	.4474	RHODIUM	MAGNESIUM	
6.20	.0051115	.5535	2721.7	.4522	RUTHENIUM	MAGNESIUM	
6.20	.0051115	.5535	2721.7	.4522	RUTHENIUM	MAGNESIUM	
6.20	.0038881	.3673	2374.5	.4532	GOLD	STRONTIUM	
6.20	.0035792	.4042	2837.9	.4690	SILVER	SILICON	
6.20	.0035133	.5566	3981.8	.3944	PLATINUM	BORON	
6.20	.0034986	.5852	4203.8	.4023	NICKEL	CARBON	
6.20	.0051582	.5431	2646.4	.4474	RHODIUM	MAGNESIUM	
6.20	.0050215	.4648	2326.3	.4716	RHODIUM	STRONTIUM	
6.20	.0047049	.4573	2442.8	.4690	RHODIUM	SILICON	
6.20	.0044803	.6592	3697.9	.4044	RHODIUM	CARBON	
6.20	.0044295	.5172	2934.8	.4450	RHODIUM	YTTORIUM	
6.20	.0044256	.6867	3900.0	.3977	RHODIUM	BORON	
6.20	.0042600	.5333	3146.5	.4367	RHODIUM	SCANDIUM	
6.20	.0044803	.6592	3697.9	.4044	RHODIUM	CARBON	
6.20	.0044243	.6728	3821.8	.4062	RUTHENIUM	CARBON	
6.20	.0035696	.5436	3827.5	.3991	GOLD	CARBON	
6.20	.0035146	.6153	4400.2	.4050	SILVER	CARBON	
6.20	.0034986	.5852	4203.8	.4023	NICKEL	CARBON	
6.20	.0034906	.5319	3829.5	.3987	PLATINUM	CARBON	

Table II. — High-index/low-index pairs that maximize peak reflectivity. Only the single pair providing highest nominal R_{peak} is provided at each wavelength.

MINIMUM 2 ALLOWED IS 5					MINIMUM 2 ALLOWED IS 5				
WAVE-LENGTH	R	N ((NORMAL) (INCIDENCE)	GAMMA ((DB + DL)	ELEMENT - E	WAVE-LENGTH	R	N ((NORMAL) (INCIDENCE)	GAMMA ((DB + DL)	ELEMENT - E
124.00	.8447	9.9	.3568	RHODIUM	SILICON	.3960	274.1	.3485	NICKEL
121.04	.7932	15.4	.3627	RHODIUM	STRONTIUM	.4038	291.0	.3473	NICKEL
118.15	.7892	15.8	.3785	RHODIUM	STRONTIUM	.4153	308.9	.3462	NICKEL
115.58	.7786	16.0	.3850	RHODIUM	STRONTIUM	.4274	328.1	.3451	NICKEL
112.58	.7738	16.2	.3922	RHODIUM	STRONTIUM	.4397	347.9	.3440	NICKEL
109.89	.7667	18.1	.3865	RHODIUM	STRONTIUM	.4443	370.2	.3429	NICKEL
107.27	.7505	19.9	.3785	RUTHENIUM	STRONTIUM	.4533	391.6	.3418	NICKEL
104.71	.7392	20.9	.3800	RUTHENIUM	STRONTIUM	.4625	418.3	.3409	NICKEL
102.21	.7280	21.9	.3814	RUTHENIUM	STRONTIUM	.4718	443.9	.3399	NICKEL
99.77	.7171	23.0	.3829	RUTHENIUM	STRONTIUM	.4812	470.8	.3388	TELLURIUM
97.39	.7165	23.6	.3899	SILVER	STRONTIUM	.4906	504.9	.3377	MAGNESIUM
95.06	.7176	24.8	.4049	SILVER	STRONTIUM	.5038	522.0	.4019	MAGNESIUM
92.79	.6966	26.4	.4099	SILVER	STRONTIUM	.5109	575.0	.3356	MAGNESIUM
90.58	.6933	27.7	.4205	SILVER	STRONTIUM	.5173	614.5	.3346	MAGNESIUM
88.42	.6313	29.1	.4344	SILVER	STRONTIUM	.5236	657.9	.3336	MAGNESIUM
86.31	.6218	42.6	.3573	RUTHENIUM	BORON	.5321	761.8	.3308	MAGNESIUM
84.25	.6210	45.4	.3503	RUTHENIUM	BORON	.5395	820.4	.3302	MAGNESIUM
82.57	.6201	48.3	.3538	RUTHENIUM	BORON	.5466	880.3	.3296	MAGNESIUM
80.92	.6201	51.3	.3586	RUTHENIUM	BORON	.5539	941.6	.3286	MAGNESIUM
79.36	.6239	54.5	.3320	RUTHENIUM	BORON	.5607	1003.9	.3269	MAGNESIUM
77.81	.6239	57.7	.3261	RUTHENIUM	BORON	.5676	1069.6	.3261	MAGNESIUM
76.26	.6287	60.9	.3204	RUTHENIUM	BORON	.5745	1138.3	.3246	MAGNESIUM
74.66	.6341	63.8	.3148	RUTHENIUM	BORON	.5815	1214.9	.3240	MAGNESIUM
72.88	.6414	66.2	.3100	RUTHENIUM	BORON	.5886	1294.9	.3211	MAGNESIUM
71.14	.6504	68.9	.3095	RUTHENIUM	BORON	.5959	1378.1	.3187	MAGNESIUM
69.44	.6504	71.1	.3095	RUTHENIUM	BORON	.6033	1463.4	.3170	MAGNESIUM
67.78	.7211	75.3	.3905	LANTHANUM	BORON	.6107	1550.6	.3157	MAGNESIUM
66.16	.8200	82.0	.4033	LANTHANUM	BORON	.6181	1639.6	.3144	MAGNESIUM
64.59	.5446	98.7	.4933	CALCIUM	STRONTIUM	.6256	1731.2	.3131	MAGNESIUM
63.04	.5097	108.6	.4924	CALCIUM	STRONTIUM	.6331	1825.1	.3118	MAGNESIUM
61.54	.4832	118.6	.3703	RUTHENIUM	STRONTIUM	.6406	1920.4	.3105	MAGNESIUM
60.07	.4832	128.6	.3668	RUTHENIUM	STRONTIUM	.6481	2017.1	.3092	MAGNESIUM
58.54	.4827	138.6	.3684	RUTHENIUM	STRONTIUM	.6556	2115.0	.3079	MAGNESIUM
57.07	.4827	148.6	.3684	RUTHENIUM	STRONTIUM	.6631	2214.0	.3066	MAGNESIUM
55.54	.4732	158.6	.3563	RUTHENIUM	STRONTIUM	.6706	2314.0	.3053	MAGNESIUM
54.07	.4732	168.6	.3521	RUTHENIUM	STRONTIUM	.6781	2415.0	.3040	MAGNESIUM
52.54	.4676	178.6	.3521	RUTHENIUM	STRONTIUM	.6856	2517.1	.3027	MAGNESIUM
51.07	.4676	188.6	.3521	RUTHENIUM	STRONTIUM	.6931	2620.4	.3014	MAGNESIUM
49.54	.4797	198.6	.3521	RUTHENIUM	STRONTIUM	.7006	2724.7	.3001	MAGNESIUM
48.07	.4797	208.6	.3521	RUTHENIUM	STRONTIUM	.7081	2829.0	.2988	MAGNESIUM
46.54	.4797	218.6	.3521	RUTHENIUM	STRONTIUM	.7156	2934.3	.2975	MAGNESIUM
45.07	.4797	228.6	.3521	RUTHENIUM	STRONTIUM	.7231	3040.6	.2962	MAGNESIUM
43.54	.4797	238.6	.3521	RUTHENIUM	STRONTIUM	.7306	3147.9	.2949	MAGNESIUM
42.07	.4797	248.6	.3521	RUTHENIUM	STRONTIUM	.7381	3255.2	.2936	MAGNESIUM
40.54	.4797	258.6	.3521	RUTHENIUM	STRONTIUM	.7456	3362.5	.2923	MAGNESIUM
39.07	.4797	268.6	.3521	RUTHENIUM	STRONTIUM	.7531	3470.8	.2910	MAGNESIUM
37.54	.4797	278.6	.3521	RUTHENIUM	STRONTIUM	.7606	3579.1	.2897	MAGNESIUM
36.07	.4797	288.6	.3521	RUTHENIUM	STRONTIUM	.7681	3687.4	.2884	MAGNESIUM
34.54	.4797	298.6	.3521	RUTHENIUM	STRONTIUM	.7756	3795.7	.2871	MAGNESIUM
33.07	.4797	308.6	.3521	RUTHENIUM	STRONTIUM	.7831	3904.0	.2858	MAGNESIUM
31.54	.4797	318.6	.3521	RUTHENIUM	STRONTIUM	.7906	4012.3	.2845	MAGNESIUM
30.07	.4797	328.6	.3521	RUTHENIUM	STRONTIUM	.7981	4120.6	.2832	MAGNESIUM
28.54	.4797	338.6	.3521	RUTHENIUM	STRONTIUM	.8056	4228.9	.2819	MAGNESIUM
27.07	.4797	348.6	.3521	RUTHENIUM	STRONTIUM	.8131	4337.2	.2806	MAGNESIUM