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FERROELASTICITY AT THE CRITICAL POINT OF HYDROGEN IN NIOBIUM

J. TRETkowski, J. VÖLKLI and G. ALEFELD

The relaxation strength of the Gorsky-effect increases strongly in the region of the critical point of H in Nb (Phys. Rev. Letters 1969, 22, 697). In recent experiments on Nb with 34 at % H (~ critical concentration) reversible elastic after effects up to 3000 % has been observed. The temperature dependence of the relaxation strength $\Delta$ follows very well a Curie-Weiss law ($\Delta \sim (T - T_c)^{-1}$). In contrast to gases and ferromagnets no deviation from Curie-Weiss was observable 30° above $T_c$ ($T_c = 177 ^\circ$C).

DISCUSSION

Rapporteur : P. GOBIN

P. Gobin (Lyon). — Dans les alliages dont M. Tretkowski vient de nous parler vous avez établi un parallèle entre le comportement près du point critique et une transition au point de Curie dans un solide ferromagnétique. Dans ce type de transition on montre que le temps de relaxation tend vers l'infini au point de transformation. Pouvez-vous préciser ce parallèle ?

G. Alefeld (Jülich). — It is a phase transition of second order since Mr. Tretkowski used the critical concentration and, therefore, you expect this behaviour similar to the behaviour of a ferromagnetic-solid without magnetic field. If you make measurements not at the critical concentrations you can make the analogy to a magnetic transition by considering the magnetic transition with a magnetic field applied. Now in regard to the phenomena of critical slowing down, Mr. Tretkowski has shown that the diffusion coefficient goes to 0; since the relaxation time is proportional to the inverse diffusion coefficient, this means the relaxation time goes to infinity at the same rate in temperature as the relaxation strength goes to infinity.

Parisot (Poitiers). — 1) Pouvez-vous préciser le mode de sollicitation des échantillons ?

2) D'autre part les échantillons sont-ils polycristallins ou monocristallins ?

G. Alefeld (Jülich). — To answer the first question:

In Mr Cannelli's work, these are flexion modes of foils which are being excited. In the case of the relaxation experiments the sample consisted of springs of a total length of approx. 80 cm. A torque was applied, that means bending of the individual segments, so it is a bending mode of wire type specimen.

The second question.

These specimens had a « bamboo » structure. They were single crystals with dimensions longer than the diameter of the wire. The specimen had a strong texture; so it was essentially single crystals (in fact very few grains associated with the « bamboo » structure) which had in the case of Niobium 110 direction, always twisted around the axis of the sample.