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ABSTRACT

An excimer laser operating in air at a wavelength of 248 nm and a pulse lenght of 25 ns was used to induce oxidation the surface of high chromium tool steel. Prior to the treatment the steel samples were hardened and tempered. The microstructure consisted of a tempered martensite and carbide precipitates with some retained austenite. After the heat treatment the samples were polished to a mirror like surface finish. A multielement refractive beam homogenizer was used to create a uniformly illuminated square spot of area approximately 0.25 mm^2. The samples were scanned in front of the laser spot. The scan speed was chosen for appropriate overlap in order to obtain multiple pulses per position. A laser fluence of approximately 1 J/cm^2 was used. The oxide film was characterized by ion beam analysis (elastic backscattering of protons and He^+-ions, nuclear reactions $^{16}O(d,p)^{17}O$, $^{12}C(d,p)^{13}C$, and $^{14}N(d,\alpha)^{12}C$) and X-ray diffraction. Tribological performance of the oxidized surface was evaluated utilizing a pin-on-disc test.