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Plasma nitriding of ultra high pure Chromium metal

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Chromium one of the "Nitro-elements" has a good tendency to form nitrides. It shows a complete liquid solubility with nitrogen but there exist two intermediate phase CrN and Cr2N in the solid state. Cr2N is stable over lower temperature and lower concentration of nitrogen while it decomposes to 2Cr2N = 2CrN + N2 at a temperature above 1050C. Chromium Nitride (CrN) coating is excellent with high wear, high abrasion, and high oxidation resistance. Electroplated hard Cr improves the wear and corrosion resistance but the resistance of hard Cr layer decreases abruptly above 350 C due to formation of micro cracks. To overcome this shortcoming, the surface of the hard Cr layer is modified by surface treatment techniques such as ion implantation or plasma nitridng. Among other conventional technique plasma nitriding is a better option as the target material is continuously subjected to a flux of ions and neutrals present in the glow discharge. The bombardment of these ion and neutrals removes the thin oxide film present on the surface of chromium by sputtering and simultaneously promotes diffusion of nitrogen. The absorption of nitrogen at the surface as well as diffusion causes the closure of cracks and improvement in the corrosion properties. Several papers has been reported on the plasma nitriding of electroplated chromium metal but very few work has been done on the plasma assisted nitriding of pure chromium metal. A maximum of 5 wt % Cr is nitride, however in the present investigation nitriding of 99.96 % pure chromium metal is done. The diffusion of nitrogen on the chromium surface is affected by gas pressure, different proportion of the gas mixture, bias voltage of the substrate, temperature of nitriding. In this paper the diffusion of nitrogen as a function different proportion of gas mixture and time of nitriding is done.

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