Surface Modification of EN353 Gear Material by Chromium Plating and Plasma Nitriding to Improve Surface Properties, Corrosion and Wear Resistance

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The objective of this work is to find out the optimised parameters to modify the surface properties of EN353 steel by increasing the hardness, and minimizing the loss in wear volume and enhancing the friction resistance in the material. The heat-treated samples of bare substrates were further plated with hard chromium followed by plasma nitriding to modify the surface of the EN353 steel. The nitrided chrome plated specimens were tested in 3.5 wt. % NaCl to test the corrosion properties. Microhardness and tribological properties results indicated that the plasma nitrided chromium plated EN353 steel offers higher hardness and low coefficient of friction when compared to other specimens used in the current study. The microstructure, wear and corrosion studies revealed that the modified layers reduce cracking and spalling on EN353 gear surfaces while electrochemical studies demonstrated an excellent corrosion resistance for the plasma nitrided EN353 steel. The usability of hard chromium plated and plasma nitrided EN353 material in place of hardened one improves the service life of the automotive gear application.

Keywords: Hard chromium plating; Plasma nitriding; Heat treatment; Tribological; Microstructure; Electrochemical; Coefficient of friction

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