

Enhancement of Hardness and Corrosion Resistance of Plasma Nitrided Low Alloy Tool Steel

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Abstract : This study concerns improving the corrosion resistance of low alloy steel after plasma nitriding performed at variable time and temperature. Nitriding carried out in the temperature range of 450-550°C for a various time period of 1-8 hrs. at 500Pa in a glow discharge plasma of H₂ and N₂ (80:20). The substrate was kept biased negatively at 250V. Following nitriding the X-ray diffraction studies shown that the phases formed were mainly γ' (Fe₄N) and ϵ (Fe₂₋₃N). The ϵ (Fe₂₋₃N) phase found to be the dominating phase. Cross sections of the samples under scanning electron microscope point analyses revealed the presence of nitrogen in the surface region. For the assessment of corrosion resistance property, potentiodynamic polarization tests were performed in 3.5% NaCl solution. It has been shown that the plasma nitriding significantly improved the corrosion resistance when compared to the as-received steel. Furthermore, it has also been found that nitriding for 6h has more corrosion resistance than nitriding for the 8h duration. The hardness of the nitrided samples was measured by Vicker's microhardness tester. The hardness of the nitrided steel was found to be improved much above the hardness of the steel in the as-received condition. It was found to be around two-fold of the initial hardness.

Keywords : corrosion, steel, plasma nitriding, X-ray diffraction

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