

Effect of shot peening on plasma nitriding microstructure and properties of 4Cr5Mo2V steel

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Third-times shot peening(TSP) was conducted on 4Cr5Mo2V hot-stamping die steel prior to plasma nitriding(PN). The optical microscopy(OP), X-ray diffraction(XRD), white-light interferometer, microhardness tester and ball-on-disk wear tester were employed to investigate the microstructure and properties of plasma nitrided 4Cr5Mo2V steel coupled with TSP processing. The results show that, compared with the PN sample, the γ' -Fe₄N phase content increased significantly, diffraction peak intensity of the sample increased by approximately 300% and the nitriding layer showed greater toughness after pre-TSP treatment. Meanwhile, the surface hardness, the thickness of the white bright layer and the effective hardened layer of the sample increased by approximately 5.9%, 37.5% and 10.7%, respectively. This could be attributed to an increase in the contact area of nitrogen atoms, dislocation density and subcrystal refinement. Additionally, Samples nitrided after TSP processing has the better wear resistance than PN sample, wear scar depth and wear rate decreased by 8.1% and 14.7%, respectively.

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