

The effects of active screen sizes on the surface properties of tempered steel treated by active screen plasma nitriding

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Abstract

Plasma nitriding, known also as ion nitriding is a kind of thermochemical surface treatment. Plasma nitriding provides an industrially important technique for modifying the surface layers of steels to improve their surface hardness and wear-resistance. The process enriches the steel surface with nitrogen to enhance its mechanical and tribological properties. The nitrided layer resulting from this thermochemical process comprises two sublayers: an outer compound layer and an underlying diffusion zone (layer). The compound layer is often composed of ϵ -Fe₃N and γ' -Fe₄N nitrides [1-4]. The DCPN (direct current plasma nitriding) has been industrially accepted, but the ASPN (active screen plasma nitriding) is more and more widespread. The biggest difference between these processes is that in ASPN the plasma appears on the cage which is the cathode, and the workpiece is completely isolated from the chamber.

In this study the sample surfaces of tempered steel treated by the active screen process. The technological parameters were: 2,1 torr pressure, 495°C temperature, 4 hours treatment time, 72%N₂-25%H₂ mixture gas with 1 L/min flow rate. We worked with three different hole-sized and two different diameter cages, which means the experiments were made in six different layouts. The evaluations showed that the used cage diameter highly effects the formed compound zone thickness. The different distances of the cage and the workpiece cause various surface roughness and morphology. These properties were examined with scanning electron microscope and atomic force microscope.

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