PO1046

Influence of the Texture on the Plasma Nitriding of AISI 304L

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Austenitic stainless steels (ASS) are widely used in chemical and in food industries due to their corrosion resistance. Since the wear resistance of ASS is poor, the surface hardness can be significantly improved by plasma nitriding diffusion treatment. The diffusion in austenitic steel is known to be grain orientation dependent. Therefore, knowledge about the microstructure before and after the nitriding process is required to describe the influence of the grain orientation on the nitriding behavior and the resulting properties.
In the present study, EBSD texture measurements of AISI 304L annealed in solution and three cold-rolled states with polished surfaces are examined at identical positions before and after plasma nitriding. Moreover, three samples of each state were arranged radially in the nitriding furnace. The nitriding process was carried out at 420°C for 6 h. The local nitrogen contents were measured using EDS and hardness was analyzed using nanoindentation. Corrosion initiation tests were performed.
Prior to the nitriding, the samples show different textures caused by cold-rolling. However, during the nitriding process texture changes occur which could be observed for each grain as well as a local distortion. The distortion increases with the cold-rolling degree and with plasma nitriding due to incorporation of nitrogen at interstitial lattice sites. In general, nitriding induced texture changes are less pronounced with a higher degree of deformation. No grain coarsening is observed for any deformation degree. Furthermore, no influence on texture by the radial positioning occurs. After the nitriding process a swelling of single grains is monitored. These grains exhibit higher nitrogen contents and show a near {100} orientation, due to a higher nitrogen diffusion. However, those grains do not show higher hardness. In addition, results inidcate, that the grain orientation influences the corrosion initiation.

Keywords
plasma nitriding
austenitic stainless steel
texture
hardness
corrosion