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Plasma Boriding

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The wear resistance of parts in mechanical engineering and automotive industries can be improved by optimizing their surface using heat treatments like plasma nitriding or -carburizing. Nevertheless in case of combined stress of high abrasive wear, adhesive stressing and very high shearing forces, most kind of economical surface modification will overload. In particular the boriding process renders the possibility of producing layers with excellent properties under these stressing conditions. However in industrial scale of plasma diffusion treatment only plasma nitriding and carburizing are widely applied, plasma boriding has not achieved the necessary market maturity until now, even though plasma boriding of steel leads to the same excellent wear protection as harmful powder or paste boriding. The formation of pores during the plasma boriding with BCl_3 is the problem that has to be solved. To overcome the difficulties in plasma boriding it is necessary to optimize the treatment gas distribution in the process chamber. Successful experiments about the up-scaling of the plasma boriding to an industrial size were carried out at the IOT after computer simulation of thermochemical reaction and fluid dynamic behaviour. It was found that the residence time of the treatment gas correlates with the formation of pores in the surface. This paper reports on the progress made recently in up-scaling the plasma boriding, especially in pore formation and layer uniformity by a new furnace layout and a new gas distribution system. The optical emission spectroscopy was used to determine the treatment gas during the glow discharge. These results were used to select plasma process parameters to reduce or avoid the formation of pores in the treated substrate material. The structure analysis was done by XRD diffraction and SEM, the component distribution was determined by GDOS and the mechanical properties as hardness and wear resistance by universal hardness and pin on disc test. Results will be presented in detail on the conference.

Keywords
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