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**Newest developments in Plasma Diffusion Treatment**

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Plasma diffusion treatment has been used in industry for more than forty years now. Many of the long-standing processes are still used daily. However, extensive new developments were necessary to keep plasma diffusion treatment competitive. Industrial use of plasma nitriding and plasma carburizing of ferritic steel started in the 70s and 80s. Surface hardness and wear resistance were the important technical features at this time. Nowadays, the requirements of surface treatment processes are much more versatile. As a matter of course the wear protection is still the reason for most of the plasma diffusion treatments, but properties like corrosion protection, electrical conductivity or surface morphology become more and more important. Therefore, over the years, plasma diffusion processes were optimized and tailored to operating conditions. Besides the desired technical properties of treated parts, the development of new steel alloys and the application of austenitic stainless steel required changes in the methods. A brief introduction to the plasma diffusion treatment outlines the way to the current state of the technology. Then the contribution exemplifies the influence of high plasma voltage on the growth rate of the compound layer of alloyed steel. The high voltage is possible due to the modern arc-management system in the latest generation of plasma generators. After 2 h at 800 V the compound layer thickness is the same as after 16 h at 500 V. A second example of plasma diffusion is the boriding of tool steel without the formation of pores. PVD diffusion treatment, a B<sub>4</sub>C coating with additional heat treatment, allows understanding the diffusion processes and the reason for the formation of pores. The latest scientific research shows efforts focused on plasma diffusion treatment of steel, titanium, nickel-based alloy and aluminum.

**Keywords**

Plasma Diffusion Treatment

Nitriding

Boriding

Compound Layer Thickness

Wear Protection