

## Investigations on the corrosion behavior of plasma-nitrided austenitic stainless steels

P. M. Reinders<sup>1,2</sup>, G. Bräuer<sup>1</sup>

<sup>1</sup>*Institute for Surface Technology, Braunschweig*

<sup>2</sup>*Fraunhofer Institute for Surface Engineering and Thin Films IST, Braunschweig*

[p.reinders@tu-braunschweig.de](mailto:p.reinders@tu-braunschweig.de)

Austenitic steels are known for their high corrosion resistance, but at the same time have low hardness, resulting in low wear resistance. A common method for improving the tribological properties of austenitic steels is plasma nitriding. The formation of the so-called  $\epsilon$ -phase results in a strong lattice distortion in the surface area, which leads to an increase in hardness, but also to an increase in roughness. To maintain corrosion resistance, process parameters such as temperature and duration must not exceed a certain limit, otherwise chromium nitrides may form. In addition, the roughening of the surface can also influence the corrosion behavior.

The aim of this research project is to isolate the effects of plasma nitriding and the resulting roughening on the corrosion behavior. The material used was the austenitic stainless steel 1.4404, on which various surface roughness's were initially set. A low-temperature plasma nitriding process was used as treatment to minimize the probability of chromium precipitation. The corrosion investigations were carried out by potentiodynamic measurements at room temperature with variation of the electrolyte (5% NaCl und 0,05 m H<sub>2</sub>SO<sub>4</sub>) and by other technique.

As can be seen in the figure, there is a clear difference between the electrolytes on the corrosion resistance of the austenitic stainless steel and on the other hand, it can be seen that plasma nitriding has different effects on the corrosion behavior. Both effects can be attributed to a modified chemical reaction at the surface. These could lead to a better understanding in the research field of bipolar plates.

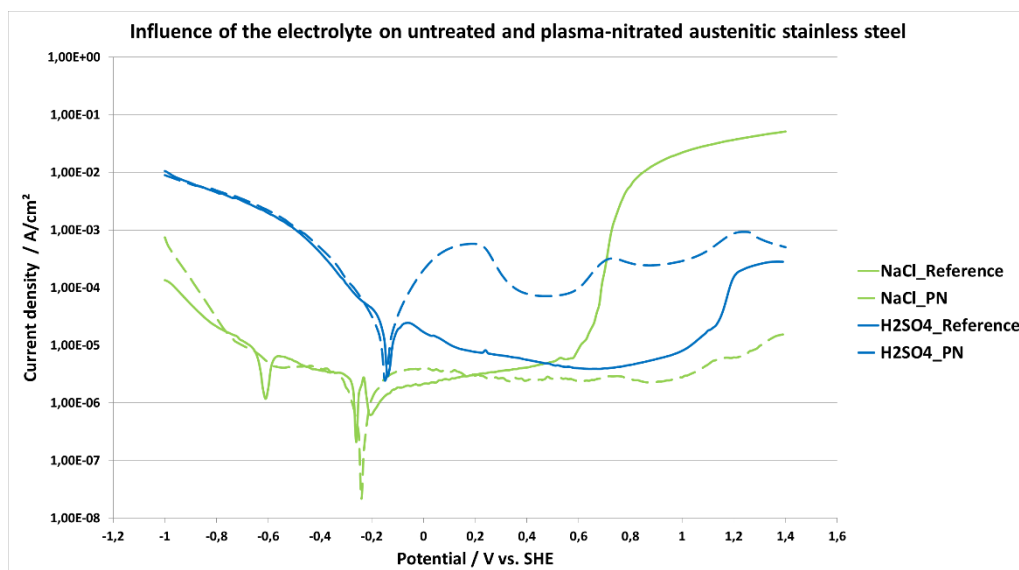


Figure 1: Potentiodynamic measurement under variation of the electrolyte for untreated and plasma-nitrided samples.