

EIS investigation of the corrosion resistance of uncoated and coated Nd-Fe-B magnets in PBS solution

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The aim of this work was to investigate the corrosion behavior of powder metallurgy produced Nd-Fe-B magnets and to evaluate the corrosion protection afforded by two different surface treatments: a phosphate conversion and a non-functional silane (BTSE) layer. The electrochemical tests were performed in a phosphate buffered solution (PBS) at neutral pH, which ionic concentration coincides with that of the human body. The corrosion behavior was monitored by means of electrochemical impedance spectroscopy (EIS) and anodic potentiodynamic polarization curves, and SEM-EDS analyses were used to monitor coating deposition. EIS response has evidenced a porous electrode behavior for the Nd-Fe-B magnets according to the de Levie theory. The results also indicated a good performance of the phosphate layer, whereas the BTSE layer did not improve the corrosion resistance of the magnets. The good anticorrosion performance of the phosphate layer was explained on the basis of the formation of an insoluble phosphate layer both on the electrode surface and on the pore walls. Precipitation of insoluble Nd phosphate on the Nd-rich phase also contributes to the superior corrosion protection afforded by this coating.