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Fabrication of High Corrosion Resistance Aluminum via Nanostructural Engineering for Sustainable Salt-Making Industry

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Summary

Aluminum and its alloys are widely used for various engineering applications. Because the corrosion of aluminum is a serious problem during the usage of aluminum products, novel surface finishing process must be developed for corrosion protection. Here, we reported a novel corrosion-resistant porous alumina via anodizing aluminum in a new electrolyte, etidronic acid. The aluminum specimens were anodized at a constant current density of 30 Am^{-2} in various electrolyte solutions. Typical sulfuric and oxalic acids operated at low voltages for galvanostatic anodizing. Citric acid led to a burning phenomenon at high voltage and the subsequent formation of nonuniform porous alumina. Conversely, a uniform porous alumina with a thick barrier layer was formed on the aluminum surface at high voltage measuring approximately 200 V via etidronic acid anodizing. This porous alumina exhibited a higher corrosion resistance in concentrated alkaline solutions than the porous alumina formed in sulfuric acid and oxalic acid solutions. As the porous alumina film formed via etidronic acid anodizing was immersed in boiling water, many plate-like hydroxide scales formed at the bottom of the pores, and the thickness of the hydroxide layer increased with the immersion time. As a result, the porous alumina was completely sealed with the hydroxide. A thick barrier alumina layer was maintained at the bottom of the porous alumina after pore-sealing.