

Assessment of Pitting Corrosion in Anodized 2xxx Aluminum Alloys

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This work focus on the characterization of pitting corrosion initiated in 2xxx Al alloys anodized in Tartaric Sulphuric Acid (TSA), specifically the 2024-T3 alloy substrates, and the 2198, in the T8 and T851 tempers. The results were compared to that of anodized pure Al (99.99 wt.%). The pitting corrosion resistance of the anodized samples was tested by potentiodynamic polarization in 0.1 mol L⁻¹ NaCl solution. The tested surfaces were then characterized by optical microscopy, optical profilometry, scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and image analysis by ImageJ. The polarized samples presented pits of different sizes. Some pits presented diameters of several hundred microns, with the anodic films remaining as pit covers. The pits in all anodized samples showed similar characteristics, such as, a continuous pit cover with a central hole or a pit cover detached from the substrate in some small areas. The central hole serves as a diffusion channel for dissolved species within the pits. Detachment of the pit cover occurs due to accumulation of corrosion products within the pits leading to swelling of the anodic film and its detachment from the substrate. The results showed that pit size and depth analysis measured by optical profilometry can be misleading. Depth assessment should be carried out after removal of the anodic layer followed by cross-section of the anodized sample. The pits developed under highly occluded conditions. It was also observed that in the anodized alloys, as opposed to pure Al, pits are related to the defects in the anodic films due to dissolution of micrometric intermetallic particles during the anodizing process. Pitting attack propagation occurred according to the microstructure characteristics of the tested material.