Internal Stress Formation and Changes in Oxide Films on a Lead Alloy Anode Surface

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Internal stresses significantly influence the mechanical, structural, and electrochemical performance of oxide films on lead alloy substrates. In this study, internal stress formation and changes on oxide films formed *in situ* on a lead anode surface were evaluated with Raman spectroscopy. The results showed that stress changes were highly dependent upon the morphology and phase composition of the oxide film, as determined by scanning electron microscopy and X-ray diffraction. PbO/PbO₂ films generated in the chromium(VI) electrolyte obviously induced compressive stress in the initial oxidation stage, followed by tensile stress. However, PbO/PbO₂ films obtained using SO₄²⁻ and Cl⁻ electrolytes were attributed to the influence tensile stress over the entire oxidation time. PbCrO₄ and PbSO₄ films compositions contributed to the development of compressive stress. The coupling of changes in compressive and tensile stresses on oxide films tended to generate microcracks, leading to an increase in the electrical conductivity of the films.

Keywords: Internal stresses; lead substrate; anode; oxide films; oxidation

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