Influence of Lanthanum and Barium on the Electrochemical Properties of Grid Alloys in Lead-Acid Energy Storage Batteries

Shaoqiang Yang¹, Xianyu Cai², Ruhong Li¹, Baofeng Yang^{1,2}, Xinguo Hu¹, Changsong Dai^{1,*}

¹ MIIT Key Laboratory of Critical Materials Technology for New Energy Conversion and Storage, School of Chemistry and Chemical Engineering, Harbin Institute of Technology, Harbin, Heilongjiang, 150001, PR China, E-mail: changsd@hit.edu.cn;

² Key Laboratory of Electrochemical Energy Storage Technology Enterprises of Jiangsu, Shoto Group Co. Ltd. Taizhou, Jiangsu, 225300, PR China

*E-mail: changsd@hit.edu.cn

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Lead acid battery is the most preferential option for energy storage application because of its mature manufacturing technology, reliability and high safety. Nonetheless, a negative trait is that the lead–calcium (Pb–Ca) alloy may suffer severe corrosion as a result of long-term depth discharge. Herein, corrosion resistance property has been implemented by cyclic voltammetry (CV) approach and the concentration of Pb²⁺ in the mixture solution (acetic acid, nitric acid and hydrogen peroxide) are measured for the first time by inductively coupled plasma atomic emission spectrometry (ICP-AES) after corrosion test. The addition of the lanthanum (La) and barium (Ba) can improve the corrosion resistance of Pb–Ca–Sn–Al alloy in sulfuric acid electrolyte. Furthermore, the outstandingly high conductivity of the oxidation film on aforementioned alloy electrode is achieved because the growth of PbO in the oxidation film is inhibited by the La or Ba in Pb–Ca–Sn–Al alloy. Meanwhile, the addition of La or Ba can improve oxygen evolution performance of alloy electrodes in sulfuric acid electrolyte.

Keywords: Lead alloys; Anodic films; Lead acid battery; Energy storage application

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