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Abstract

Oxidation Kinetics of an Equimolar Li-Sn Alloy with Liquid Paraffin Coatings †

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Lithium-Tin (Li-Sn) alloys are an attractive solution for plasma facing components of nuclear fusion reactors and have received considerable attention regarding lithium-ion batteries. Mechano-synthesis by means of high energy milling is a suitable solution for the preparation of tailored alloys for testing. Although solutions have been proposed to achieve the production of some specific alloys, the description and understanding of the reaction path remains rather incomplete.

Phase characterization of Li-Sn milled powders by X-ray diffraction is challenging due to fast lithium oxidation when samples are handled and exposed to air, and due to the low X-ray lithium cross-section. In this work, in the context of the phase evolution of an equimolar Li-Sn batch mixture produced by high energy milling, the suitability of liquid paraffin, a saturated hydrocarbon, to act as oxygen and water vapour diffusion barrier is investigated. Samples without barrier coating were also tested as reference. All samples were prepared and handled inside a glovebox with a pure argon atmosphere with O_2 and H_2 concentration below 0.1 ppm, before being exposed for characterization.

Liquid paraffin is an appealing solution as it is cheap, it is inert regarding lithium, and its non-volatility allows for it to be handled inside a glovebox without release of volatile species that would disturb its environment. The effectiveness of liquid paraffin was assessed in detail by a combination of scanning electron microscopy, X-ray diffraction, thermogravimetric analysis, and differential scanning calorimetry. A simple oxidation model is proposed to describe the oxidation behaviour of the prepared samples at PTN (with and without the paraffin coating) either during the thermogravimetric experiments or under X-ray exposure.

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