Measurement of the Diffusion Coefficient of Lithium in Tin Thin Films Including Phase Transformation Effects

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Tin belongs in the class of lithium alloy-forming materials. Its high theoretical specific capacity of 990 mAh/g makes it an attractive candidate for use in lithium-ion batteries.

Determination of the lithium diffusion coefficient in tin is important for studying its use in lithium-ion batteries. In this work, tin thin-films are characterized. Thin films are attractive because it simplifies data analysis, and can be used in solid-state batteries.

The Galvanostatic Intermittent Titration Technique (GITT) is widely used for diffusion coefficient measurements [1]. Traditionally, this technique assumes transport is purely diffusion-controlled. However, in tin and many other battery materials, phase transformations occur during charge and discharge [2].

Here the lithium diffusion coefficient in tin thin-films is estimated by correlating the galvanostatic intermittent titration results to simulations that include the effects of phase transformations. These simulations are performed using the finite-element modeling software COMSOL.

References

1. C. John Wen, B. A. Boukamp, R. A. Huggins and W. Weppner, *J. Electrochem. Soc.*, 126 (1979) 2258.

2. R. A. Huggins, *J. Power Sources*, 81–82 (1999), 13.