Silicon-Germanium based anode coatings for Lithium-ion batteries

Lithium-ion batteries (LIBs) have taken over a major role in the field of energy storage since several years. Especially in sectors such as portable devices, renewable storage systems and electric vehicles this technology is already dominating the market. In order to meet the ever-increasing requirements such as durability, energy density and manufacturing costs, it is essential to implement new performance-enhancing materials into the cell architecture. Group IV elements as Silicon (Si) and Germanium (Ge) are considered to be appealing alternatives to commercial graphite anodes due to their high energy capacity. In this respect, Si is becoming the focus of research due to the highest theoretical capacity (4200 mAh g^{-1}) and low working potential. Additional advantages such as environmental friendliness, resource abundance and low cost have prompted several research groups around the world to look closer into this topic. However, the cycling performance and the rate capacity of these novel anodes are still limited by the low intrinsic electron conductivity and poor Li^+ diffusivity. In addition, Ge can provide better cyclability and a dramatically improved electron conductivity into the system. Within this thesis we focus on diblock copolymer templating of Si/Ge thin films as novel anode materials for LIBs. Here CR2032 Litihium-ion coin cells will be manufactured (see Figure 1). Mayor topic will be an extensive study on different anode coatings with real and reciprocal space analysis methods. The study is finalized by battery specific measurements as impedance spectroscopy and long time cycling test.

Figure 1: CR2032 cell

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