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Plasma processing of graphite micropowder for improving the electrochemical capacity of Li-ion intercalation batteries

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Graphite is nowadays the material of choice for the negative electrode in most Li-ion intercalation batteries (LIBs) utilized in portable electronic devices. However, its relatively low electrochemical specific charge capacity (theoretically 372 mAh g^{-1}) impedes it from being used in those applications, such as vehicle electrical propulsion, where much higher available capacity is required. A possible approach to improve the material performance consists of realizing a Si/graphite composite material, which shows good galvanometric-cycling stability and available capacity up to 6 times higher compared to pure-graphite one. Towards this end, an innovative processing technique for graphite micropowder based on plasma-enhanced chemical vapor deposition (PECVD) was developed [1] [2]. In this study the results of PECVD of Si-containing coatings onto a synthetic flaky graphite micropowder (TIMREX® provided by IMERYS Graphite & Carbon) are presented. The PECVD experiments were performed in the pressure range 10 to 100 Pa with a glow-discharge reactor designed for micropowder processing. The processed micropowder was examined with characterization methods including galvanometric cycling, scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS), spark-discharge-in-argon optical emission spectrometry and powder diffractometric sizing. The obtained results show that the PECVD can modify the surface characteristics of graphite without alteration of powder size distribution. SEM and XPS show the presence of a Si-containing coating on the surface of the processed powder. The galvanometric results are related to the coating characteristics to demonstrate the potential of the PECVD as a feasible and versatile tool for improving the performance of graphite-based LIBs.

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Keywords
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