INNOVATIVE CERAMIC COATINGS PREVENTING ANODIC DISSOLUTION IN LITHIUM ION BATTERIES

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Commercial lithium ion batteries (LIBs) typically work with liquid electrolytes based on organic carbonates and lithium hexafluorophosphate ($LiPF_6$). These chemicals tend to thermal decomposition and the formation of hydrofluoric acid if traces of water are present. Therefore, imide-based conductive salts like lithium bis(trifluoromethylsulfonyl)imide (LiTFSI) could replace $LiPF_6$. However, this promotes the loss of the established protection layer on the aluminum current collector formed of a mixture containing aluminum fluoride and oxide in the first charge/discharge cycle. The corresponding $Al(TFSI)_3$ shows high solubility in organic solvents; thus, no protective layer can be formed. Consequently, anodic dissolution of the aluminum current collector may occur. To overcome this drawback, innovative ceramic coatings can serve as protection layers. In this context, excellent adhesion and a dense microstructure are mandatory to guarantee separation between current collector and liquid electrolyte. Further prerequisites are electrochemical stability up to 5 V vs. Li/Li^+ and good electronic conductivity. We try to fulfill all these requirements by deposition of ceramic films using magnetron sputtering with a special program for changing coating conditions during the process. This method enables the deposition of dense and crack-free layers even on a flexible substrate like aluminum foil. The characterization of the samples was done by x-ray diffraction, scanning electron microscopy, cyclic voltammetry and chronoamperometry.