

***Operando* NMR analysis of Li plating on graphite and hard carbon electrodes**

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Carbon materials, such as graphite or hard carbon, have been used as active materials on negative electrode in lithium ion batteries (LIBs). While the batteries are overcharged (over-lithiated), Li metal is deposited on the surface of carbon electrode as dendrite, which is the cause of short circuit of the battery. Therefore, precise analysis of the nucleation and growth of lithium dendrites during lithiation/over-lithiation is important for enhancement of the safety. We applied *operando (in situ)* analysis of solid state nuclear magnetic resonance (SSNMR) to observe the Li plating on graphite electrode and hard carbon electrode while the electrodes were lithiated/over-lithiated by 0.3 C. Li plating on the graphite electrode starts at almost the same time with the minimum of electric potential during over lithiation. In the case of hard carbon, a start of Li deposition is 50 minutes later than the appearance of the minimum of electric potential. We conclude that Li plating on the surface of the electrode starts after a formation of Li clusters in the closed pore of hard carbon.