

Li Ion Coordination Structures Prevail over Solid Electrolyte Interphases

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Graphite anodes are not stable in most non-carbonate solvents (e.g., ether, sulfoxide, sulfone) upon Li ion intercalation, known as an urgent issue in present Li ions and next-generation Li–S and Li–O₂ batteries for storage of Li ions within the anode for safety features. The solid electrolyte interphase (SEI) is commonly believed to be decisive for stabilizing the graphite anode. However, here we find that the solvation structure of the Li ions, determined by the electrolyte composition including lithium salts, solvents, and additives, plays a more dominant role than SEI in graphite anode stability. The Li ion intercalation desired for battery operation competes with the undesired Li⁺–solvent co-insertion, leading to graphite exfoliation. The increase in organic lithium salt LiN(SO₂CF₃)₂ concentration or, more effectively, the addition of LiNO₃ lowers the interaction strength between Li⁺ and solvents, suppressing the graphite exfoliation caused by Li⁺–solvent co-insertion. Our findings refresh the knowledge of the well-known SEI for graphite stability in metal ion batteries and also provide new guidelines for electrolyte systems to achieve reliable and safe Li–S full batteries.

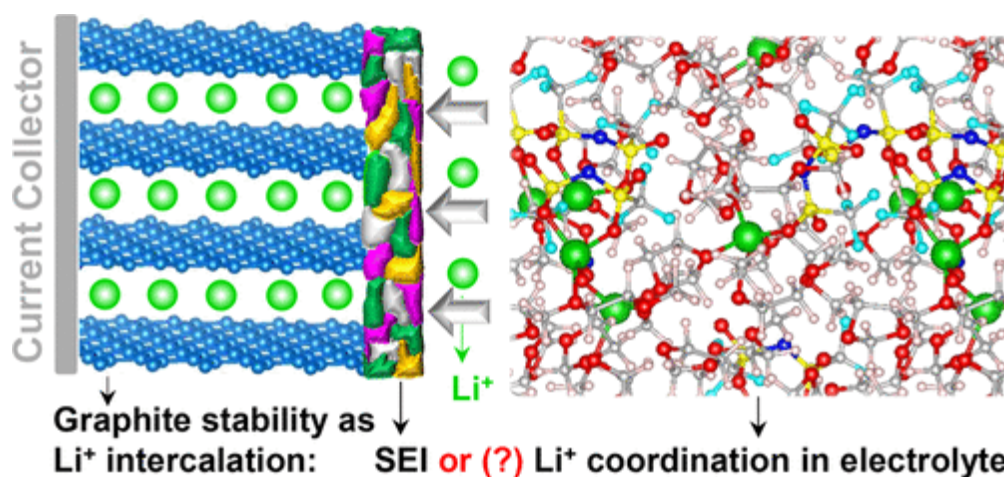


Figure 1. Schematic view of the discovered controversial issue for the stability of a graphite anode in a Li ion battery: SEI vs. Li ion coordination structure.

References:

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