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Synthesis of Si/G Composite Anodes for Lithium-Ion Batteries: A Review

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Abstract. By overcoming significant performance constraints, recent developments in silicon/graphene (Si/G) composite anodes have shown promise for revolutionizing lithium-ion batteries. Although silicon has a remarkable theoretical capacity, structural instability results from its large volume growth during cycling. Though it lacks the potential for high-energy applications, graphene, which is well-known for its exceptional mechanical flexibility and electrical conductivity, enhances the qualities of silicon. By combining these materials, Si/G composites have demonstrated impressive gains in rate performance, structural stability, and capacity retention, providing a promising avenue for next-generation energy storage technologies. High-performance Si/G composites have been made easier to create by advancements in scalable synthesis processes like sol-gel processing, chemical vapor deposition, sophisticated self-assembly techniques and Hummer's method. With an emphasis on cutting-edge silicon-based anodes, carbon composites, and workable techniques for acquiring and altering silicon anodes, this review seeks to examine the most recent developments and unsolved issues in the advancement of lithium-ion batteries. In order to address the needs of contemporary high-capacity applications and expedite the integration of Si/G composites into next-generation energy storage systems, these insights are crucial.

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