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Revolutionizing energy storage: exploring the nanoscale frontier of all-solid-state batteries

Yedluri Anil Kumar, †[a] Nipa Roy, †[b] Tholkappiyan Ramachandran, [cd] Mohammed A. Assiri, [e] Sunkara Srinivasa Rao, [f] Md Moniruzzaman *[g] and Sang Woo Joo *[h]

Author affiliations

Abstract

Due to their distinctive security characteristics, all-solid-state batteries are seen as a potential technology for the upcoming era of energy storage. The flexibility of nanomaterials shows enormous potential for the advancement of all-solid-state batteries' exceptional power and energy storage capacities. These batteries might be applied in many areas such as large-scale energy storage for power grids, as well as in the creation of foldable and flexible electronics, and portable gadgets. The most difficult aspect of creating a comprehensive nanoscale all-solid-state battery assembly is the task of decreasing the particle size of the solid electrolyte while maintaining its excellent ionic conductivity. Materials possessing nanoscale structural features and a substantial electrochemically active surface area have the potential to significantly enhance power characteristics and the cycle life. This might bring about substantial changes to existing energy storage models. The primary objective of this research is to summarize the latest advancements in utilizing nanomaterials for energy harvesting in various all-solid-state battery assemblies. This study examines the most complex solid–solid interfaces of all-solid-state batteries, as well as feasible methods for implementing nanomaterials in such interfaces. Currently, there is significant attention on the necessity to develop electrode–solid electrolyte interfaces that exhibit nanoscale particle articulation and other characteristics related to the behavior of lithium ions.