Shape-Controlled Nano-Hybrids Prepared via an Ionothermal Process for Electrochemical Device

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In this research, room-temperature ionic liquids (RTILs) are considered as hierarchically multi-functional components by employing not only templates and co-solvents for fabricating nanostructured materials but also proton conductors for electrochemical devices. RTIL-aluminum hydroxide (RTIL-Al) hybrids containing various nanoshapes from 1D shapes of nanorods with hexagonal tips, straight and curved nanofibers, and nanofibers embedded in a porous network to 3D octahedral, polyhedral, and angular spherical shapes were synthesized via an one-pot ionothermal process. The structures or shapes of the RTIL-Al hybrids were controlled by the anionic moieties, alkyl chain length of RTILs, and humidity during fabrication. The shape-controlled nanohybrids showed the enhanced electrochemical properties compared to those of a conventional hybrid prepared by mixing RTILs and aluminum hydroxides, exhibiting ten-fold or higher proton conductivity under anhydrous condition and thermal stability as a result of the continuous proton conduction channel and one-pot assemblied nano-confinement.