Synthesis of Hierarchically Large-Mesoporous Gamma-Alumina by Multi-functional Room Temperature Ionic Liquids and its Characterization

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A hierarchically large-mesoporous gamma-alumina was fabricated through ionothermal process by integrating multi-functions of 1-hexadecyl-3-methylimidazolium chloride (HMimCl) as room-temperature ionic liquids (RTILs), i.e., templating and solvent functions. In this synthesis, ionothermal process is a key step to induce the nanoshape and nanostructure of aluminum hydroxide and transform to boehmite crystallites by means of cooperative interaction. FT-IR and XRD shows supramolecular coassembly during ionothermal treatment, resulting from hydrogen bonding between anions of HMimCl and aluminum hydroxides and π-π stacking of imidazolium rings. Both boehmite and gamma-alumina displayed a hierarchical nanostructure consisting of a 1D randomly debundled nanofiber and a wormlike porous network. Nanofibers of gamma-alumina displayed a length of ca. 40-60 nm and a diameter of ca. 1.5-3 nm. After conversion from boehmite crystallites into gamma phase, the fabricated gamma-alumina displayed large surface area and pore volume with ca. 10nm large mesopore compared to conventional alumina.