Continuous one-pot synthesis of surface-modified ceria oxide nanoparticles using supercritical methanol for highly stabilized nanofluids

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Continuous one-pot synthesis of surface-modified ceria oxide (CeO_2) nanoparticles in supercritical methanol was examined by introducing a solution of ceria (III) nitrate ($Ce(NO_3)_3$) and decanoid acid (as a surface modifier) in methanol to a continuous flow reactor system. Morphologies and surface properties of the nanoparticles before and after the surface modification was observed by fourier transform infrared (FTIR), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and wide angle X-ray diffraction (WAXD). It was shown that decanoic acids were chemically bonded onto the surface of the CeO_2 nanoparticles. The TEM results showed that the presence of the organic modifier significantly affected the particle shape and morphology. WAXD analysis revealed the surface-modified nanoparticles had CeO_2 crystalline structure. The nanoparticles showed good dispersion stability in ethylene glycol.