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Effect of calcination temperature on CeO_2 nanoparticle size distribution synthesized via microemuslsion method

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Cerium oxide with the chemical formula CeO_2 is an inorganic compound which is widely used in formulation for industrial purposes. CeO_2 nanoparticles in the form of catalyst or catalyst support have a beneficial application in emission reduction or low-temperature water-gas shift reaction. In this research, we synthesized CeO_2 nanoparticles via microemulsion method and investigated the effect of calcination temperature on the size of particles. Cerium nitrate hexahydrate and diethanolamineoleate were used as precursor's salt and nonionic surfactant respectively. For this purpose, the calcination temperature was varied in the range of 400^{0}C to 600^{0}C with the temperature step size of 50^{0}C. X-ray Diffraction Spectroscopy (XRD), Scanning Electron Microscopy (SEM), Transmitted Electron Microscopy (TEM), and Brunauer–Emmett–Teller (BET) analysis preformed to characterize the obtained nanoparticles. XRD patterns confirmed the formation of CeO_2 nanoparticles. SEM and TEM images illustrated that the particles formed clusters with spherical shape in the nanosize range. These results were completely in agreement with the XRD results. Furthermore, increasing the calcination temperature resulted in the formation of larger particles. Hence finest particles (average 3.90 nm) were found under optimum condition which was 0.001 mol of cerium nitrate, 0.02 mol of surfactant, and calcination temperature of 400 ^{0}C. The average specific surface area of obtaining nanoparticles at optimum condition was 58.43 m^2/g.

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