Study of the Thermal Properties of Compact Nanoparticles as Function of Their Size by the Photoacoustic Technique

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This work reports the synthesis of silica nanoparticles using the Stöber method. Particles with different diameters were obtained by hydrolysis and condensation of tetraethyl orthosilicate (TEOS) in an ammonium hydroxide and alcohol solution. We varied the ammonium hydroxide to allow control of size, shape, and dispersion of the silica nanoparticles. We observed mainly spherical and monodisperse silica nanoparticles. Employing different amounts of catalyst (10-2 ml), we obtained nanoscale SiO_2 particles with 90 to 660 nm diameters. When we employed higher ammonium hydroxide concentrations, there were bigger silica nanoparticles. The effect of size of the silica nanoparticle on thermal properties reveals an increase of thermal diffusivity about the biggest silica nanoparticles. The thermal diffusivity was determined by photoacoustics, using the open photoacoustic cell (OPC) method. Scanning electron microscopy (SEM), transmission electron microscopy (TEM), and electron dispersive scanning (EDS) were used for silica nanoparticles characteristics.