142aj Morphology, Composition and Thermal Stability of Flame-Made Zirconia-Based Mixed Oxides

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Yttria stabilized zirconia (YSZ) of 8-31 nm of average crystallite and particle diameter containing 3-10 mol% yttria are made by flame spray pyrolysis (FSP) of various yttrium and zirconium precursors at production rates up to 350 g/h. Product particles are characterized by N_2 adsorption (BET), transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDS) and X-ray diffraction (XRD). The effect of liquid precursor composition on product particle morphology, composition and crystallinity is investigated. The process enthalpy and the ratio between the solvent boiling point and the melting or decomposition point of the metal precursor are identified as the key parameters for the formation of homogeneous or hollow and inhomogeneous particles. The thermal stability of pure and doped zirconia made by flame spray pyrolysis (FSP) are studied by calcination at various temperatures and residence times. The metastable tetragonal structure of flame-made ZrO_2 transforms into monoclinic after sintering. Doping zirconia with yttria, ceria, lanthanum oxide, alumina or silica increases its thermal stability and also hindered that phase transformation. For all doped powders no monoclinic phase forms during calcination. The combination of 25wt% ceria, 10 wt% lanthanum oxide and 65 wt% zirconia has the highest thermal stability.