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Synthesis of uniformly porous NiO/ZrO_2 particles

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Abstract

Porous NiO–ZrO_2 particles were successfully synthesized using a spray-drying method with polystyrene latex (PSL: 400 nm) as a template and starting materials that included NiO powder (7 nm) and ZrO_2 sol (1.2 nm). Porous particles with an average diameter of 4.5 μm and nearly spherical, narrow pores with an average size of ~300 nm were obtained from the precursor at a pH of 3.7. The Brunauer, Emmett and Teller (BET) surface area of the prepared particles was relatively high—about 27 m^2/g. When the solution pH was increased to 9.7, the particle morphology became completely spherical, indicating that the morphology of prepared particles can be controlled by adjusting the pH. Calcinations at 900 and 1200 °C were carried out to estimate the thermal stability of the prepared particles, which had shrinkage of less than 36%. The existence of these pores means that various applications, such as electrodes and catalysts, will be possible for the prepared particles.

Graphical abstract

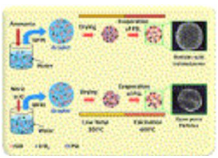

Figure options

Research highlights

► NiO–ZrO_2 porous particles were successfully synthesized using spray drying method. ► Solution pH influences the morphology of NiO–ZrO_2 particles. ► The specific surface area decreases with an increase of calcination temperature. ► NiO–ZrO_2 porous particles have a good thermal stability.

Keywords

A. Composites; B. Chemical synthesis; C. Thermogravimetric analysis (TGA); C. X-ray diffraction; D. Surface properties