

Spectro-thermal characterization of the nature of sulfate groups immobilized on tetragonal zirconium oxide: Consequences of doping the oxide with Al or Mg cations

Abstract

The present investigation was designed to characterize influence of doping with Al or Mg ions on nature and acidity of sulfate species dispersed on tetragonal-zirconia. Pure and doped zirconias were prepared by the citrate method. Sulfating of the thus produced zirconias was carried out by impregnation with aqueous solutions of $(\text{NH}_4)_2\text{SO}_4$. The material bulk structure was elucidated by X-ray powder diffractometry and Laser Raman spectroscopy, whereas the surface sulfate was characterized via thermal and mass spectrometric analyses, and Fourier-transform infrared spectroscopy. The sulfate acidity was probed by IR νCCN spectra of adsorbed pyridine, and TPD of adsorbed n-propylamine. Results obtained showed the Al-doping to improve sulfate monolayer at the expense of overlayer structure, as well as its acidity. In contrast, Mg-doping influenced favorable bonding sites for polydentate sulfate of high