

## **Impedance Spectroscopical Investigations of Sulfated Zirconia Catalysts**

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Impedance spectroscopy is regarded as an effective tool to study processes in the interfacial region of multiphase systems and electrical properties of porous solids. It has been successfully applied to zeolites and related nanostructured solids [1].

Mesoporous sulfated zirconia (SZ) was characterized regarding the polarizability and other related dielectric parameters. Especially changes due to adsorption/desorption of guest molecules (pyridine) or reactant/product molecules (n-butane or iso-butane) were investigated. Additionally, some information about diffusion processes of fresh and partly deactivated samples are available which may give new insights into the catalytic behaviour of SZ.

Zirconia precursors were produced from zirconyl nitrate solutions by aging the precipitate at 298 K for 1 h. After drying, the samples were sulfated with ammonium sulfate (20 mol% nominal content) and subsequently calcined for 3 h at 873 K. The samples were equilibrated in a pyridine atmosphere for at least 24 h after activation at 673 K and cooling down to room temperature in dry air. All impedance measurements were carried out in a one-compartment cell where the pyridine loaded sulfated zirconia tablets were contacted with gold electrodes in a special clamping device.

The impedance spectra were recorded in a frequency range of 10<sup>6</sup> Hz to 0.1 Hz and fitted to appropriate electrical circuits.

The obtained spectra showed significant differences in their ohmic, capacitive and diffusional behavior due to their pretreatment, especially in the case of adsorption/reaction with n-butane prior to the pyridine adsorption.

To study how the desorption process affects the dielectric parameter of the pyridine loaded sulfated zirconia several consecutive spectra were recorded during the pyridine desorption step under ambient temperature. Diffusion coefficients calculated from suitable equivalent circuits could be estimated and compared.

[1] Simon U., Franke M. E. *Micropor. Mesopor. Mat.* **41** (2000) 1-36.