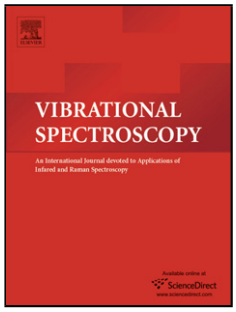

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Spectroscopic study of radical cation species formed on sulfated TiO_2 upon benzene adsorption

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Abstract

Sulfated TiO_2 is well known for its high acidity, which is due to the presence of sulfate ions that create strong Brönsted and Lewis acid sites. The Lewis acid sites can also exhibit oxidizing properties. As previously observed for sulfated ZrO_2, the greater the strength of the acid site, the greater the oxidative potential.
The oxidative ability can be evaluated by the interaction with a substance with high ionization potential such as benzene. Benzene was adsorbed on sulfated TiO_2 at room temperature, and the species formed from the interaction was investigated by Raman and electron spin resonance (ESR) spectroscopy. Resonance Raman spectra of adsorbed benzene showed bands that are distinct from bands observed in the spectra of neutral molecules. Furthermore, from the absorption spectra in the visible and near-infrared it was possible to identify these species as phenylene oligomer radical cations. Also, aromatic radical cations were detected by ESR spectra. Although they were present in small amounts, these cations may be responsible for the bands observed in the Raman spectra because of the resonance Raman effect signal enhancement.

Keywords: sulfated titanium dioxide, benzene, radical cation, EPR, Raman spectroscopy.