Operando Raman spectroscopy of industrial SO_2 oxidation catalysts under reaction conditions

Background:

The industrial production of sulfuric acid involves the oxidation of sulfur dioxide, which is catalyzed by a silica-supported phase consisting of V_2O_5 species dissolved in a pyrosulfate melt with Na, K and Cs added as promoters. As the molten phase is only present during the catalytic reaction and solidifies at room temperature, *in situ* studies are necessary to address the working state of the SO_2 oxidation catalyst. In an industrial converter, the catalyst environment is dependent on the position along the reactor. In particular, lower reactor beds exhibit a higher SO_3/SO_2 ratio. Due to the harsh corrosive environment in presence of SO_3, and the tendency of SO_3 to form sulfuric acid in presence of water, a direct investigation of the catalyst in lower-bed conditions has not been attempted so far.

The Project:

We use *operando* Raman spectroscopy to correlate the chemical state of industrial and model vanadia-based SO_2 oxidation catalysts with different promoters and the level of feed preconversion.

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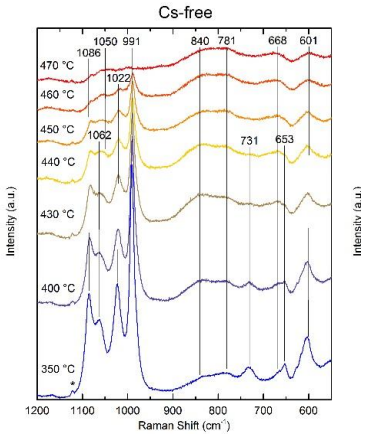

Operando Raman spectra acquired during cooling of Cs-free model catalyst from 470 °C (red curve) to 350 °C (blue curve) in process gas (10% SO_2 10% O_2 in N_2).

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