

## Effects of Adsorbate Coverage and Bond Length Disorder on the d-Band Center in Carbon-Supported Pt Catalysts

Determination of the factors affecting the d-band center in catalysts is required for explaining their catalytic properties. Resonant inelastic X-ray scattering (RIXS) enables direct imaging of electronic transitions in the d-band of Pt catalysts in real time and in realistic environmental conditions. Through a combination of in situ, temperature-resolved RIXS measurements and theoretical simulations we isolated and quantified the effects of bond length disorder and adsorbate coverage (CO and H<sub>2</sub>) on the d-band center in 1.25 nm size Pt catalysts supported on carbon. We obtained that the decrease in adsorbate coverage at elevated temperatures is responsible for the d-band shifts towards the higher energies relative to the Fermi level while the effect of the increase in bond length disorder on the d-band center is negligible. Although these results were obtained for a specific case of non-interacting support and weak temperature-dependence of the metal-metal bond length in a model catalyst, this work can be extended to a broad range of real catalysts

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