Adsorption of CO on Nickel-decorated Muscovite Mica

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Clays are porous materials that can provide a large surface area to efficiently support nanosized metal catalysts. Muscovite mica is a clay mineral that forms large crystalline flakes and is therefore well suited as a model system for clays for surface analytic studies [1].

Adsorption of carbon monoxide on nickel-decorated muscovite mica is studied using the surface analysis techniques X-ray photoelectron spectroscopy (XPS), temperature programmed desorption (TPD), and atomic force microscopy (AFM). The mica surface is cleaned by hydrogen atom bombardment, then nickel is evaporated by thermal or e-beam evaporation onto the surface. Carbon monoxide is found to not adsorb on clean mica surfaces, but adsorbs readily when nickel is evaporated onto the mica surface. Three main desorption peaks from TPD of carbon monoxide are found, around 250-280 K, 350-420 K and 550-600 K. The results show that there is a coverage dependent adsorption, with the low temperature desorption dominant for small cluster sizes (<0.5 monolayer coverage) and the high temperature desorption for thicker coverages (>2 monolayer). For the intermediate coverage, all profiles are present. Kinetic desorption parameters are found for the different samples, with desorption energies ranging from 0.1 to 1.25 eV depending on nickel amount and CO coverage.

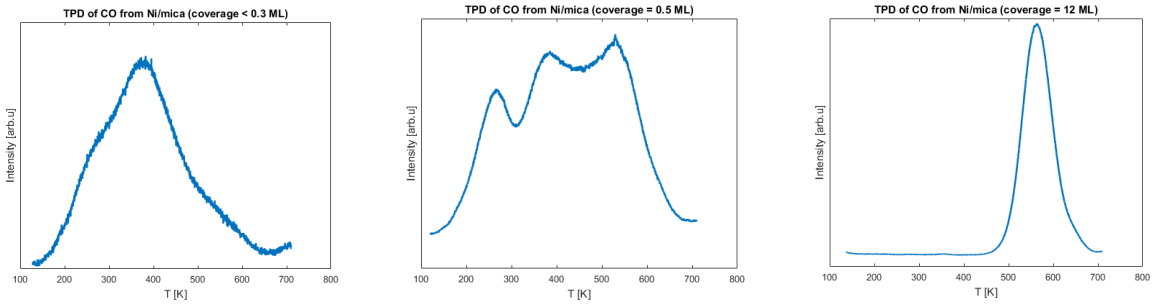

Figure 1: A selection of TPD measurements (1 K/s) of 1 Langmuir of CO on <0.3 ML, 0.5 ML and 12 ML nickel covered mica.

References:

[1] de Poel, W., Pintea, S., Drnec, J., Carla, F., Felici, R., Mulder, P., ... & Vlieg, E. Surface Science, **619**, 19-24 (2014)