Low Energy Electron Microscopy Investigation of CO Adsorption on the Pt(111) Surface

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The adsorption of gasses on surfaces can have a dramatic impact on the elastically reflected electron intensity at very low incident energy. This means that there is significant potential for detecting concentration gradients with laterally resolved measurements in low energy electron microscopy (LEEM). Using LEEM, we have investigated changes of the elastically reflected electron intensity that are caused by CO adsorption on the Pt(111) surface. We find that the largest change of the LEEM intensity occurs at incident energy of 15.7 eV during CO exposure at room temperature. At this energy, the LEEM image intensity changes by a factor of over 30 times between the clean surface and saturated surface at high CO exposure, corresponding to 0.5 monolayer (ML) CO coverage. When this change is spread out over the intensity levels of the 12-bit CCD camera, LEEM is sensitive on average to variations of CO coverage of 1×10^{-4} ML. Before this sensitivity can be fully exploited, however, it is necessary to convert CO exposure to coverage in order to reveal the explicit relationship between LEEM intensity and CO coverage. This was done by comparison to results from electron energy loss spectroscopy for site dependent CO coverage vs. exposure. We find that the LEEM intensity saturates considerably earlier than the total CO coverage reaches saturation (Fig. 1). This suggests that the LEEM intensity measurement is not equally sensitive to adsorption in atop and bridge sites. This conclusion are supported by work function measurements that were made by examining the onset of the mirror mode.

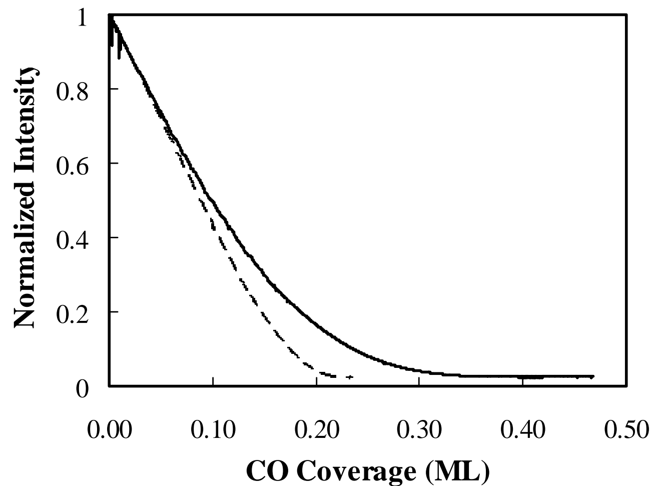

Fig. 1: The normalized elastically reflected electron intensity measured with LEEM at incident energy of 15.7 eV is plotted vs. total CO coverage (solid curve) and CO coverage in atop sites (dashed curve).