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Ultrafast laser excitation of CO/Pd (111) probed by sum frequency generation (SFG): Pump laser energy effect on the induced CO photo-desorption

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The desorption of CO from Pd (111) induced by femtosecond laser pulses is probed by IR + vis sum frequency generation (SFG). A large redshift of the main band, a broadening, and a strong decrease in intensity are observed; these originate from coupling of C-O stretch to low frequency modes (the frustrated rotation). Simulation based on two temperature model of electron and phonon heat baths within the substrate, show that CO desorption from the Pd(111) is an electron-mediated process, this corresponds well with the results obtained by two pulse correlation. SFG spectra show a development of a second band at high frequency at negative delay, which disappears at positive delay, due to an interference phenomenon between disturbed and undisturbed states of the SFG pulse. The CO desorption is becoming important with increasing the pump energy. We compared CO photo-desorption from Pd(111) to others metals, indeed the most probable hypothesis that makes the difference between metals is the position of CO 2p* adsorbate resonance, into which substrate electrons may be excited. Other factors may play a role as the distance and the strength of CO-Metal.

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