Abstract

The structural influence of vicinal Ru(0001) surfaces to water adsorption and desorption kinetics was investigated. Flat Ru(0001) surfaces show an unique behavior in the difference of H_2O and D_2O desorption spectra - referred to as the isotope effect. In accordance with other authors we observed on Ru(0001) three desorption peaks for H_2O denoted as C, A_2 and A_1 (C, 155 K / A_2, 190 K / A_1, 212 K). The isotope effect for D_2O on Ru(0001) is characterized by a missing A_1 peak. Isothermal desorption measurements were performed using $\Delta\phi$, in order to determine the different kinetics for H_2O and D_2O. Neither for D_2O nor for H_2O the desorption of the A_2-state can be described by first order kinetics. Especially for the A_2 peak of H_2O we observed an initial range of first order kinetics followed by a strong deviation, which could be described by Avrami kinetics. Stepped Ru surfaces were used for comparison and $\Delta\phi$ measurements were complemented by ARUPS measurements of H_2O and D_2O adsorption. Further, we performed LEED structure calculations of the clean stepped hcp(0001)-surfaces using a spherical wave model approach and single scattering theory. In experiments the vicinal Ru(0001) surfaces show a triplet spot splitting due to the alternating step width with different atomic arrangements at the steps, in agreement with our calculations. Regarding the adsorption phenomena on low indexed stepped surfaces, the diffraction pattern do not show ordered structures of water molecules. Higher indexed surfaces allow to built ordered water super structures as observed for flat Ru(0001) surfaces.