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Cs^+ Reactive Ion Scattering from Pt(111) surface : Experiment and Theory

Jung-Hwan Kim, Rob. J. W. E. Lahaye, and Heon Kang
School of Chemistry, Seoul National University

Cs^+ Reactive Ion Scattering (Cs^+-RIS) is an experimental technique to identify neutral molecules on a surface. Low energy Cs+ ions (1-50 eV) scatter from the surface and can pick up adsorbed molecules due to the ion-dipole attraction. Because these products are ions, the Cs^+-adsorbate complexes scattered from the surface are analyzed for mass by QMS. This has been applied successfully to a variety of surfaces and adsorbed molecules, although details of the RIS scattering dynamics were not well understood.

Classical molecular dynamics simulations of the RIS process has promoted the importance of an abstraction mechanism for the pick-up of adsorbates by Cs^+ scattering from the Pt(111) surface. This theoretical analysis proposes an Eley-Rideal type abstraction mechanism, which explains the high RIS yields of physisorbed species and the much lower RIS yields of chemisorbed species, as observed in earlier experiments.

The simulation results also predict a significant difference in RIS cross-sections between physisorbed and chemisorbed species. In recent experiments, we have measured the variation of Cs^+-RIS cross-sections for O, CO, CO_2 and D_2O on Pt(111), in order to verify the theoretical prediction and find experimental evidence for the proposed Eley-Rideal type abstraction mechanism.