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Ionic-to-Metallic Layer Transition in Cs Adsorption on Si(111)-(7×7). Charge-State Selective Detection of Adsorbate by Cs⁺ Reactive Ion Scattering.

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Adsorption of alkali metals on a silicon surface has attracted much attention due to its importance in metal-semiconductor interface technology. In particular, the bonding nature of alkali metal to silicon substrate has been a focus of fundamental research efforts. We examined the adsorbed layer of Cs on a Si(111)-(7×7) surface by reactive ion scattering (RIS) of hyperthermal Cs⁺ beams. RIS from a Cs-adsorbed surface gives rise to Cs₂⁺, representing pickup of surface Cs by Cs⁺ projectile. The Cs₂⁺ intensity is proportional to surface coverage of Cs at a high substrate temperature (473 K), while it varies anomalously with Cs coverage at low temperatures (130-170 K). This observation indicates that RIS selectively detects metallic Cs on surface, but discriminates ionic Cs. Transition from ionic to metallic Cs adlayer is driven by thermal diffusion of Cs and their clustering process.