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Real-time Observation of Molecular Seesaw Motion

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The adsorption structures and the molecular dynamic motions of vinylferrocene on Ge(100) have been studied using scanning tunneling microscopy (STM) under ultrahigh vacuum (UHV). The STM investigation revealed that vinylferrocene adsorbs onto the Ge(100) surface with three different geometries: Ge-Fe dative bonding configuration, di-σ boding configurations, and Ge-Cp configuration. The series of STM images for the Ge-Fe dative bonding configuration recorded in real time shows a molecular seesaw motion. The seesaw motion is likely due to the temporal electrostatic attractive interaction between a Cp ring and a down-Ge atom. The average life time of both *centered* and *tilted* features is determined based on first-order kinetics. The di-σ boding configurations produce chiral adsorption products. Vinylferrocene was employed as a prochiral molecule and it produced a dimeric enantiomer on the surface. For the Ge-Cp configuration, one-dimensional random walk in between two neighboring Ge dimer rows was observed.