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Adsorption behavior of vinylferrocene on Ge(100)

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The adsorption structures and the nanoscale phenomena of vinylferrocene on Ge(100) have been studied using scanning tunneling microscopy(STM) under ultrahigh vacuum(UHV). The STM investigation has revealed that vinylferrocene adsorbs onto Ge(100) surface with three different geometries: (i) a Ge-Fe dative bonding configuration, (ii) a Ge-Cp dative bonding configuration and (iii) a di-σ bonding configuration through a [2+2] cycloaddition. The STM images recorded in real time demonstrate that each dative bonding feature is accompanied with distinct molecular motions at the surface. The Ge-Fe dative bonding configuration shows a single molecular seesaw motion of a ferrocene moiety. The seesaw motion is likely due to the temporarily enhanced interaction between a cyclopentadiene(Cp) ring and a down-Ge atom. In the case of the Ge-Cp dative bonding configuration, one-dimensional random walk in between two neighboring Ge dimer rows was observed. On the other hand, the di-σ bonding configurations do not show such dynamic surface motion, because the molecules bonded covalently through the [2+2] cycloaddition reaction are expected to have relatively strong interaction with the surface , compared to the molecules bound to the surface via coordinative interaction.