

## Study of Hydrogen Adsorption on Pt(111), Cu(111), and Pt-deposited Cu(111) Surfaces

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The studies on the interaction of  $H_2/H$  with the Pt(111), Cu(111), and Pt-deposited Cu(111) surfaces have been carried out for observing a chemically site-specific role of Pt-atoms. On the pure Pt(111) spontaneous dissociation of hydrogen occurs with typical second order desorption kinetic behavior. On the other hand, an activation is required on the Cu(111). When the Pt-atoms of 0.06 ML deposit on the clean Cu(111) surface, however, the dissociation of hydrogen takes place without any activation on the Cu(111) surface indicating no activated adsorption process and the spontaneous adsorption. Obviously the possibility of the spontaneous  $H_2$  dissociation is caused by the presence of Pt atoms on the Cu(111) surface, and the H atoms adsorb preferentially at Pt sites.

In comparison with the pure Pt(111), moreover, only one  $H_2$  desorption state is observed on both Cu(111) and 0.06 ML Pt-deposited Cu(111) surfaces. The maximum desorption peak of the  $H_2$  on 0.25 ML Pt-deposited Cu(111) surface at saturation coverage appears at about 220 K which is lowered as much as 80 and 90 K compared to that of the pure Cu(111) and Pt(111) surfaces, respectively. Very similar result was also obtained from the ordered  $Cu_3Pt(111)$  bulk alloy surface.

The destabilization of the H adsorption on either ordered  $Cu_3Pt(111)$  or 0.25 ML Pt-deposited Cu(111) surfaces compared with the Pt(111) surface can be explained by the lack of the Pt three-fold hollow sites on the surface. Furthermore, an influence of the altered electronic configuration of the Pt atoms could be also considered as follows. The experimental results exhibit new properties of a bimetallic surfaces with respect to the pure constituents due to a change of electronic and structural properties.