

[S-04]

CO condensation on Self-assembled monolayers above normal boiling point in UHV

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It may be unbelievable that pure water does not boil above 100°C under atmospheric pressure. The law of thermodynamics simply tells that this is not possible. Nevertheless, if heat transfer to water is somehow blocked by a certain mechanism, it could happen. We report here a similar situation in which a multilayer CO on self-assembled monolayer(SAM)-covered Au(111) surface remains condensed above the normal boiling point of 81K even under UHV condition and the desorption peak shifts from 145K to 170K with increasing exposure.

We performed TPD(temperature programmed desorption) of CO after adsorption at 90K on the alkylthiolate SAM on Au film. Multilayer adsorption is evident from the peak shape with a common leading and abrupt fall at the completion of desorption, which is characteristic of zeroth-order desorption. For 1×10^6 L CO exposure, the amount of desorbed CO corresponds to 350ML CO on Pt(111). The sticking coefficient is very low i.e., 2.5×10^{-5} . The desorption activation energy calculated from the leading edge is 49 ± 1 KJ/mol. The result clearly indicates that CO molecules condense on alkylthiolate covered Au film at 90K. According to Christmann et. al. the physisorption of CO occurs below 35K on Au(110)-(1×2) surface.(1) On the contrary on alkylthiolate SAM CO condenses above its normal boiling point of 81K even under UHV condition. This is a striking result and contradicting to thermodynamics. We believe that the condensed CO multilayer is in a metastable state probably due to the poor energy transfer through from the Au substrate. This point will be further discussed.

[참고문헌]

- [1] J.M. Gottfried, K.J. Schmidt, S.L.M. Schroeder, K.Christmann. Surface Science 536, 206 (2003)