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Electron transfer through thin layers of water between two conductors

Jae-Seock Yoon, Jung-Hyun Yoon, Chi-Woo Lee*

Department of Advanced Materials Chemistry, Korea University,

208, Seochang-Dong, Jochiwon, Choongnam, 339-700, Korea

Electron transfer is of fundamental importance to many processes in surface science and electro-chemistry.[1] We have been interested in investigating charge transfer through thin layers of water by using a scanning tunneling microscopy (STM) and a quartz crystal microbalance (QCM) techniques. The results showed that, at relative humidity below 80 %, the electron transfer was independent on the bias voltage and the tip-sample distance. On the contrary, the electron transfer at relative humidity above 90 % was strongly dependent on the bias voltage, where the plateau currents were observed in the long distance. The magnitude of the plateau currents depended on the applied electrode potential as well as its polarity. The non-exponentially for current decay has been explained in terms of a mixture of the electron tunneling and the electrochemical current.[2] However, we could not differentiate the electrochemical current from the electron tunneling because there existed a little discrepancy of energy level between Au substrates and Pt/Ir tips.

In this poster, we are, therefore, going to present the results of electron transfer through thin layers of water using Au single crystals and wires as STM substrate and tips respectively.

Also, we investigated carbon substrate and tip. Finally, $HClO_4$ and NH_4OH treatment at Pt-Ir tip / Au substrate were investigated by STM.

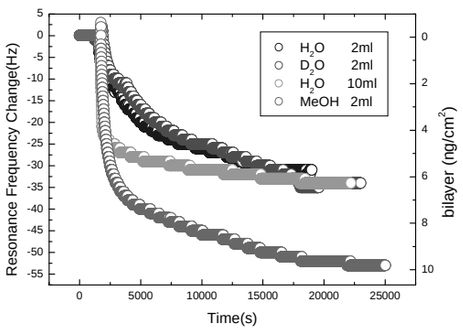

Fig. 1. Typical resonance frequency change as a function of time after introduction of water and other solvent inside an environmental chamber.

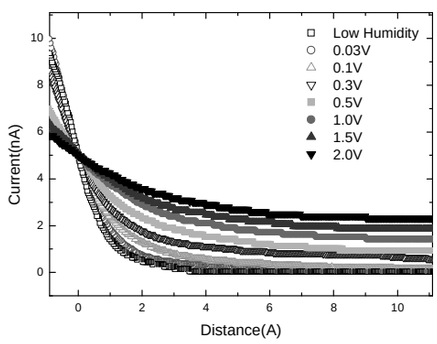

Fig. 2. Tunneling current versus distance characteristic measured on an Au(111) surface with a Gold tip at relative humidity 95% and tip bias voltage 0.03V, 0.1V, 0.3V, 0.5V, 1.0V, 1.5V, 2.0V, Low humidity.

References

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2. M. B. Song, J. M. Jang, S. E. Bae, C. W. Lee, *Langmuir*, **18**, 2780 (2002).