



Electrochemical Study of Surface Energy and Dipole Charge of Metals

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Abstract

The concept of the Fermi energy is a crucially important concept for the understanding of the electrical and thermal properties of solids. The contribution of surface energy(ω) and dipole charge(ϕ) in metals work function (WF) has been proved. On the other hand dependency of the WF with thickness has intensely been investigated by others theoretically and experimentally. So the WF as a key component of metal characteristic has been considered as an important sign of not only surface energy and dipole charge but also thickness.

In this research electrochemical technique is introduced as an suitable method to measure these parameters. Some metals (Zn, Pb, Co, Cu) with different WF were electrodeposited on the ITO for investigating. The potential of the ITO/metals with respect to an inert metal (Pt) in electrolytic media was considered as a rough approach for E_F or the WF (similar to method of contact potential difference (CPD) employed to measure metal WF in physics field). Results showed that the measured WF and surface energy in electrolyte is in good agreement with those achieved from formula proposed by W. Missol in 1973.

$$\omega = \frac{1530}{q} \frac{WF}{M^{2/3}} (Z\gamma)^{2/3} \quad (1)$$

In addition dipole charge was investigated for different thickness of metals. The calculations showed that the ϕ contribution to the electrostatic potential changes the dipole charge up to 300-800 meV for under consideration metals with different thickness. This will meet new applications in batteries, solar cells, sensors and diodes.

Keywords: surface energy, dipole charge, metal work function

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2- professor

3- professor