Work function control in oxide thin films

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Recently work function control on a few eV scale by depositing insulating films has been studied both theoretically and experimentally. In some cases the work function of metallic substrates abruptly drops by depositing ultrathin insulating films, consistent with “electron compression model” – At the metal surface, a small amount of free electrons are leaked out of the surface, giving a dipole moment, but by depositing an insulating film, the leaked electrons are pushed back and the dipole moment decreases, resulting in a reduction of work function. We report work function control in several oxide heterostructures grown by pulsed laser deposition [1].

The work function of Nb: SrTiO$_3$(100) decreased by ~ 1 eV by depositing ultrathin MgO(100) films, consistent with “electron compression model”. By using LaAlO$_3$(100) polar films, the controllability of work function was enhanced up to ~ 2 eV as shown in the figure. The present findings show that oxide heterostructures are a promising platform for developing active surfaces.


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