

Hydrogen Atom Mediated Electrochemistry in Silicon Oxide

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Silicon oxide is a good electrical insulator but not necessarily with respect to ionics. It allows significant ion current when exposed to moisture because protons can permeate. Exploiting proton-selective transport through this earth-abundant material, commercialized pH meters have been widely adopting tens of micrometer thick glass for pH sensitive compartments. Solid state electronics industry, which is one of brilliant achievements in modern world, stimulated rapid advance in silicon machining technology, currently making it possible to fabricate silicon oxide of extremely elaborate morphology and thickness on nanometer scale. As a consequence, not only size but density or crystallinity of silicon dioxide are now possibly under nano-control, offering unprecedented opportunities to electrochemistry. Thermally grown thin film of high density provides excellent proton-selectivity through minimally suppressed defects under tight control of direct tunneling current so that we see burgeons of new electrochemistry. In this talk, we will discuss the charge transfer through a thin insulating layer of the dense SiO_x and its potential for unconventional electrochemistry on the dielectric surface.