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Edges Ease Surface Oxidation Of Metals

Metal atoms detach from defects to react with adsorbed oxygen

By Jyllian Kemsley

Department: Science & Technology
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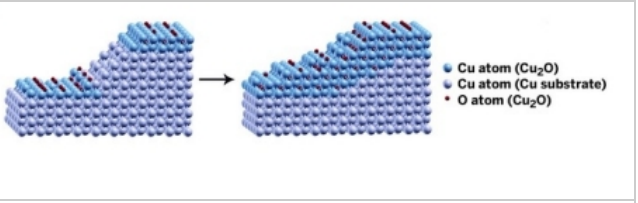

SMOOTH OXIDE
Oxide formation at a step edge on a copper surface smooths the surface.
Credit: *Phys. Rev. Lett.*

Oxidation of metal surfaces preferentially occurs when metal atoms detach from defect edges and react with adsorbed oxygen atoms, according to a report in *Physical Review Letters* (DOI: 10.1103/physrevlett.109.235502). The formation of oxide layers on metal surfaces can be corrosive, protective, or catalytically necessary, depending on the application. By using transmission electron microscopy to study oxidation of copper surfaces under low-pressure oxygen, a research group led by Guangwen Zhou of the State University of New York, Binghamton, determined that oxidation occurs as oxygen adsorbs onto the surface and reacts with copper atoms that detach from step edges and diffuse across the surface. Previous studies of surfaces with fewer defects—conducted under ultrahigh vacuum—had indicated instead that oxide layer growth requires significant bulk diffusion of oxygen atoms down into the metal lattice and metal atoms up to the surface. Zhou and colleagues found that oxidizing a flat surface leads to more stress and mechanical breakdown between the metal and oxide layers, while step-facilitated oxidation reduces stress and smooths the surface as metal atoms are drawn from the edges.

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