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Epitaxial Electrodeposition of Chiral Metal Oxide Films

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Chirality is ubiquitous in Nature. One enantiomer of a molecule is often physiologically active, while the other enantiomer may be either inactive or toxic. Chiral surfaces offer the possibility of developing heterogeneous enantiospecific catalysts that can more readily be separated from the products and reused. Chiral surfaces might also serve as electrochemical sensors for chiral molecules- perhaps even implantable chiral sensors that could be used to monitor drug levels in the body. Our trick to produce chiral surfaces is to electrodeposit low symmetry metal oxide films with chiral orientations on achiral substrates (see, *Nature* **425**, 490, 2003). The relationship between three-dimensional and two-dimensional chirality will be discussed. Chiral surfaces lack mirror or glide plane symmetry. It is possible to produce chiral surfaces of materials which do not crystallize in chiral space groups. We have deposited chiral orientations of achiral CuO onto single-crystal Au and Cu using both tartaric acid and the amino acids alanine and valine to control the handedness of the electrodeposited films. We will present results on the chiral recognition of molecules such as tartaric or malic acid and L-dopa on the chiral electrodeposited CuO. Initial work on the electrochemical biomineralization of chiral nanostructures of calcite will also be discussed.