Title:	Redox Reactions of Colloidal Metal Oxides
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Description:	It is proposed to study chemical reactions of colloidal metal oxide particles. An understanding of the chemical reactivity of nanoscale particles is critical to their use and to their behavior in the environment. There are a variety of procedures known to make well-defined colloidal dispersions of metal oxides, both in aqueous and non-aqueous solvents. Our initial studies will focus on colloidal manganese dioxide as a well-defined nanostructured oxide. Extensions to iron oxides (FeOOH, Fe_2O_3) and photo-activated TiO_2 are planned. These colloidal particles will be reacted with organic substrates such as 9,10-dihydroanthracene, toluenes, phenols, and hydroquinone. Reduction of these particles causes dissolution, which will be monitored optically and by EPR. Because the particles dissolve away completely, the average thermodynamic driving force for reaction (ΔG, ΔH) is essentially that of the bulk material. Knowledge of this thermodynamic driving force enables testing of the recently developed Marcus/Polanyi approach to hydrogen atom transfer/proton coupled electron transfer reactions of molecular metal-oxide materials. Successful application of this approach would provide new and important understanding of the reactivity of metal oxide particles.