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Electrochemical Techniques in Bioanalysis

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Medical Applications of Electrochemical Sensors and Techniques

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Photoelectrochemical Solar Energy Conversion

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Mechanism of Reactions on Colloidal Microelectrodes and Size Quantization Effects

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Small particles of metals in solution often behave like electrodes although they are not connected to a battery which determines their potential. However, when a chemical reaction occurs in the solution of such particles intermediate free radicals may transfer electrons to them. The particles are thus charged chemically and are able to act as a metal electrode on cathodic potential. Electron transfer reactions become possible at these micro-electrodes which cannot be brought about by the radicals in the absence of the colloidal catalyst.

Small semiconductor particles also act like microelectrodes upon illumination. Electrons and positive holes are created in the particles which initiate redox reactions. The charge carriers may also recombine and emit fluorescence light. Reaction with a solute leads to quenching of the fluorescence.

Besides these chemical effects, which are understood in terms of the established theories in semiconductor physics and chemical kinetics, new physico-chemical phenomena are observed in the case of extremely small particles. The metal or semiconductor behavior is gradually lost with decreasing size, the consequences being drastic changes in the optical properties of the materials and also in their photocatalytic effects.