Electrochemical Detection and Characterization of Engineered Nanoparticles

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Material manufacturing of engineered nanoparticles (ENPs) is widely expected to grow to a 1 trillion $US market by 2011. These ENPs can be found in products such as paints, cosmetics, sunscreens, medicines, industrial lubricants, tires, clothing, semiconductors and even foods. The proliferation of ENPs in commerce has prompted concerns over the safety of those that are exposed to these materials intentionally or by accident. For this reason, the detection and characterization of these ENPs in the environment has recently been identified as a major research priority (http://www.nano.gov/nnistrategicplan211.pdf). Overcoming the lack of robust methods for characterizing the presence, concentration, condition, and effects of ENPs is a prerequisite to rational monitoring, risk assessment, and regulation.

Examples of the most significant categories of ENPs include nano zero valent iron (nZVI), Ag, Zn, Fe_2O_3, TiO_2, ZnO, carbon nanotubes (CNTs) and multi-element particles such as quantum dots (QDs). The only ENP that has already been deliberately released into the environment in unsupported form and in large quantity is nano zero-valent iron (nZVI). Here, we show how the use of various electrochemical techniques ranging in complexity can be used to investigate ENPs reactivity, diagenesis, redox characterization and be used in the field to detect and differentiate nZVI from other materials in solution.

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