In situ Remediation with Nanoscale Iron Particles

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Nanoscale bimetallic (Fe/Pd, 99.9% Fe) particles are among the vanguard of a new generation of remediation technologies that could provide cost-effective remedial solutions to some of the most difficult sites. Nanoparticles feature large surface areas and extremely high surface reactivity. Equally important, they provide enormous flexibility for in situ remedial applications.

Recent research in my laboratory at Lehigh University has pioneered several synthetic methods for nanoscale metallic particles and has proved their effectiveness as reductants and catalysts for a large variety of common environmental contaminants. Our previous work also includes several field tests demonstrating the feasibility of nanoparticles for in situ remediation of contaminated groundwater.

Several key technical issues of the nanoscale bimetallic particle technology have been investigated and published at Lehigh University since 1995, the most important being the optimization and scaleup of the synthesis processes. Major results include: (1) robust methods for the synthesis of various nanoscale particles (Fe/Pd, Fe/Ag, Fe/Ni, Fe/Co, Fe/Cu etc), (2) feasibility studies (batch and column) of treatment of a wide variety (>50) of contaminants including chlorinated solvents, organochlorine pesticides, perchlorate (ClO_4^-) and chromium (Cr(VI)), PCB etc, (3) modeling and column studies of injection, transport and reactions of nanoparticles in porous media, and (4) pilot tests at several sites

On-going research in my laboratory is aimed to achieve rational design of nanoparticles with targeted size and hydrophobicity characteristics.