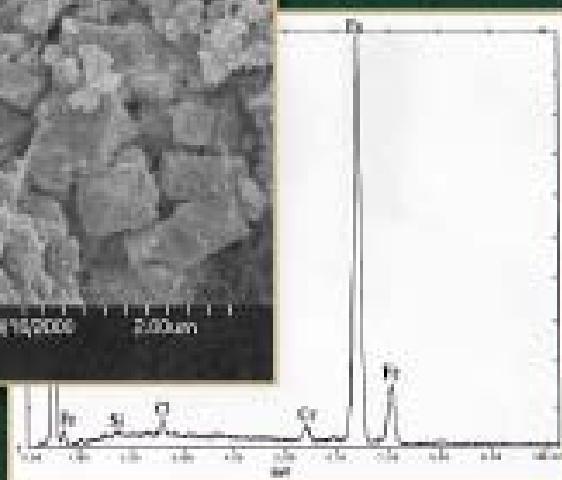
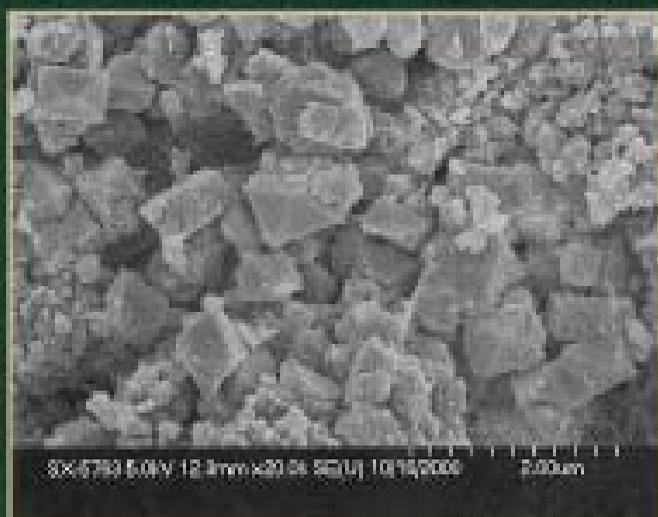
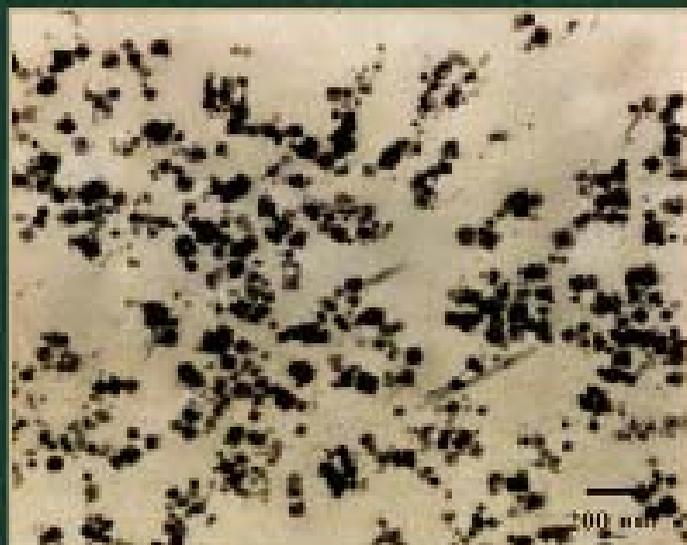
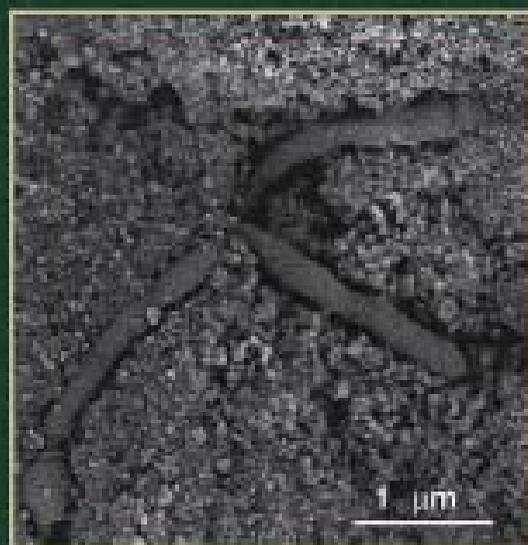


# NanoFermentation™: A Bioprocess for Manufacturing Inorganic Nanomaterials





## NanoFermentation™ Process Wins R&D 100 Award

### New Process Developed for Manufacturing Nanoscale Ceramic Powders

#### Background

- Use of nanomaterials in some applications has been limited by supply concerns, which in turn result in part from concerns about reliability of manufacturing techniques.

#### The Project

- NanoFermentation™ uses a variety of natural metal-reducing bacterial strains to create tailored, single-crystal nanoparticles of important engineering materials.
- The discovery that the bacteria can be used in industrial bioprocessing to make mixed metal oxides has created a breakthrough for large-scale synthesis of nanoscale powders.
- Particle size and morphology can be controlled by several means, including temperature, incubation time, and choice of electron donor or the addition of certain chemical additives.

#### Results

- NanoFermentation™ operates at or near room temperature, using familiar, mature industrial equipment and straightforward fermentation practices.
- The bacterial strains are completely natural and are not hazardous.
- The process can be operated over a wide range of conditions to tailor the product to particular needs and can be scaled up easily.
- NanoFermentation™ produces extremely fine, well-controlled, and highly crystalline products across a wide range of compositions.

#### Highlights

- Immediate applications of NanoFermentation™ are the manufacture of highly crystalline nanoscale particles of doped ferrites. The powders can be used for magnetic media, ferrofluids, magnetorheological media, radar-absorbant materials and coatings, microfluidic heat transfer systems, and xerographic toner.
- NanoFermentation™ can also create many other mixed transition metal oxides. Many of these materials will find application in catalysts, pigments, fluids, transport systems, and other product niches.

#### Developers:

- Tommy J. Phelps, Lonnie Love, Adam Rondinone, Yul Roh, Chuanlun Zhang, and Ji-Won Moon at Oak Ridge National Laboratory
- Robert J. Lauf, Consultant

#### For more information, contact

Tommy J. Phelps

Oak Ridge National Laboratory

Phone: 865-574-7290

Email: [phelpstj@ornl.gov](mailto:phelpstj@ornl.gov)

