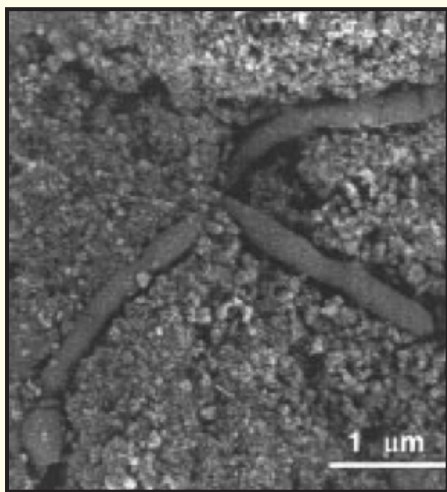


# Bacterial Production of Mixed Metal Oxide Nanoparticles

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## Technology Summary

Researchers at ORNL have developed a method for producing mixed metal oxide nanoparticles using anaerobic bacteria with an electron donor to reduce a metal oxide composition from a higher to a lower oxidation state. This method may be applied to cultures of a variety of metal-reducing bacteria to reduce the toxicity of dopant species to bacteria. In addition, the method provides a means by which bacteria with specifically tailored electron acceptors could facilitate research in bacterial respiration and metabolism.

A mixed metal oxide phase is prepared by the adsorption of at least one metal species onto the surface of a preexisting oxide of at least one other metal. A variety of metal species may be incorporated, provided this mixed oxide can be reduced by the bacteria. This invention provides a means by which the dopant species can be incorporated into the colloidal metal oxyhydroxide phase, resulting in a reduction in the toxicity of certain dopants to the bacteria.

The mixed metal oxide is then reduced to a lower oxidation state through the metabolic activity of the bacteria in combination with at least one electron donor to form a selected second mixed metal phase. The electron donor supports the respiration of the bacteria that culminates in the reduction of the mixed metal oxide. A crystalline product forms as reduction by the bacteria continues, and the dopant species is retained in the crystalline product.

## Advantages

- Reduced toxicity of dopant species to bacteria
- Synthesis of desired particles based on the selection and tailoring of bacterial strains

## Potential Applications

- Production of fine particulates of ceramic powders used by industry and in chemical processing applications

## Patent

Tommy J. Phelps, Robert J. Lauf, Ji-Won Moon, and Yul Roh, *Fermentative Process for Making Inorganic Nanoparticles*, U.S. Patent 7,060,473, issued June 13, 2006.

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