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Nanostructured metal-ceramic composites by internal reduction

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NANOSTRUCTURED METAL-CERAMIC COMPOSITES BY INTERNAL REDUCTION

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The nucleation and growth of metallic particles within metal-doped oxides exposed to reducing conditions is relevant to the processing of materials for catalysts, fuel cells, and structural applications. Here, the precipitation of metallic nickel during the internal reduction of nickel-doped yttria stabilized zirconia (YSZ) is studied with electron microscopy and SQUID magnetometry. It is shown that the microstructure evolution proceeds in three distinct stages, each with its own kinetics description, dependent on the porosity and grain size. The transitions between stages depend on concentration gradients and electrostatic potentials that act upon the relevant transporting species, namely oxygen vacancies, electrons, nickel ions and zirconium vacancies. An understanding of these mechanisms enables the design of specific nanostructures.

Reimanis Bio
Ivar Reimanis currently serves as interim Department Head for the Metallurgical and Materials Engineering Department at Colorado School of Mines in Golden, Colorado. He holds the Hermann F. Coors Distinguished Chair of Ceramic Engineering at Mines. Ivar earned his PhD at the University of California at Santa Barbara working under Tony Evans. He did postdocs at the Max-Planck Institute in Stuttgart and Los Alamos National Laboratory and was a staff member at Los Alamos, before joining Mines in 1994.