Particles, properties, and random mixtures

**Abstract:** “Random composite materials” are generally defined as disordered mixtures of at least two distinct materials, where we are interested in the effective average properties of the mixture. In this seminar, I will focus on random composites consisting of particles of a different material embedded in a matrix material. There are issues of size and shape at the particle level, and issues of microstructure and properties at the composite level. I will discuss these topics in the context of particle intrinsic properties and shape, metal-based additive manufacturing, indentation modeling applied to atomic force microscopy, using and analyzing X-ray computed tomography, and computation of electromagnetic scattering from carbon nanotubes and graphene composites. Both experimental and computational approaches, and their synergistic combination, will be presented.

**Edward Garboczi, Ph.D.**

Dr. Garboczi received his Ph.D. in Condensed Matter Physics from Michigan State University in 1985. His main research at NIST (Gaithersburg, MD) starting in 1988 was on the computational materials science of random composites such as concrete, later including nanocomposites. Since 2000, he has also used a novel combination of X-ray computed tomography and spherical harmonic analysis to build quantitative mathematical models of random-shaped particles of cement, sand, gravel, fly ash, industrial mineral powders, and blast furnace slag, with other applications including simulated and real lunar soil. He went on to application of these methods to powders used in additive manufacturing, and to electromagnetic scattering from nanocomposites. In 2014, he transferred to NIST-Boulder, working on the same kind of problems but for a wider range of materials and techniques, including indentation modeling applied to atomic force microscopy. Dr. Garboczi is a NIST Fellow, and a Fellow of the American Ceramic Society and the American Concrete Institute. He received the L’ Hermite Medal from RILEM in 1992, a Silver Medal from the Department of Commerce in 2009, the 2009 Edward C. Henry award from the American Ceramic Society’s Electronics Division, the 2012 Della Roy Lecture award from the American Ceramic Society’s Cements Division, and the 2014 Robert E. Philleo award from the American Concrete Institute.