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Multifunctional Polymer-Matrix Nanocomposites

Multifunctional composites are a class of composites that are both structural and functional. When a polymer is used as the matrix, it facilitates processing and structural integrity while the reinforcement phase adds different functionalities. With the discrete reinforcement phase assuming a nanometer scale dimension, the resulting large interfacial area enhances interface-based functional performance while improving structural integrity as well. Thus multifunctional polymer-matrix nanocomposites are opening the door to many new applications.

The two key parameters affecting the performance of a nanocomposite are the uniform particle dispersion and the interfacial integrity. Agglomeration of particles effectively increases the particle size, thereby annihilating the benefits of small size. A poor interfacial state such as poor particle/matrix bonding no doubt reduces the strength of the composite.

The present talk discusses a few different methods of functionalizing surfaces of nanoparticles to improve particle dispersion and interfacial strength. Two types of reinforcement morphologies are included in the discussion: 0-dimensional sphere and 2-dimensional platelet. Results will be shown on the effects of particle functionalization on mechanical, electrical, optical, and magnetic properties of various nanocomposites.

Dr. Hahn is the Raytheon Distinguished Professor in the Mechanical and Aerospace Engineering Department with a joint appointment in the Material Science and Engineering Department, UCLA. He also serves as editor-in-chief of the *Journal of Composite Materials*.

Dr. Hahn's research interests cover a wide spectrum of composites technology ranging from design and analysis to processing and manufacturing. His current research focus is on multifunctional polymer nanocomposites and nanomanufacturing. His work in composites started in 1972 when he was with the Air Force Materials Laboratory. Before joining the UCLA faculty in 1992, he was the Harry and Arlene Schell Professor at Penn State. Other previous experiences include a professorship at Washington University in St. Louis and research positions at the Lawrence Livermore National Laboratory and the University of Dayton Research Institute. He served as an IPA/Program Manager of the Mechanics of Materials and Devices Program at the Air Force Office of Scientific Research from 1999 till 2001.

Dr. Hahn has a B.S. (1964) degree in Mechanical Engineering from Seoul National University, Korea, and M.S. (1968) and Ph.D. (1971) degrees in Engineering Mechanics from Penn State University.