

# Smart Design: Multifunctional Cement-Based Materials

**D**eborah D.L. Chung, Niagara Mohawk Chair Professor of Materials Research, and her research team explore multifunctional structural materials for infrastructure. Their goal is a structural material to serve one or more non-structural functions while retaining good structural properties.

A particularly valuable function is sensing. A self-sensing structural material allows the structure to "feel" what is going on, allowing the structure to be programmed to respond to the situation in an appropriate fashion. A structure that has such capabilities is said to be smart. Sensing is the most basic function of a smart structure.

The self-sensing of strain (i.e., deformation) is a function that is useful for vibration sensing and control, traffic monitoring, weighing, room occupancy monitoring, intruder detection, building security and facility management. In particular, room occupancy monitoring allows building energy savings through automatic control of the lighting, ventilation, air conditioning and heating in accordance with the number of people in each room. Additional benefits of such a material would include reduced cost, enhanced durability and repairability, increased functional volume, avoided

degradation of the mechanical properties, and simplified design.

The research, which has been partially funded by the National

Science Foundation, continues to be very fruitful. The functions attained in multifunctional cement-matrix composites include the self-sensing of strain, damage and

temperature, self-heating and electromagnetic interference (EMI) shielding. The research program has resulted in approximately 100 journal publications since 1993; a book entitled Multifunctional Cement-Based Materials, Marcel-Dekker, in press; an issued patent; and worldwide press coverage.

