

Ceria Nanoparticles as Anti-inflammatory Agent in Engineered Articular Cartilage: *In vitro* Raman Microspectroscopy of Single Cells

**Sathish Ponnurangam¹, Irina Chernyshova, ¹Grace O'Connell², Katherine Woods², Clark T. Hung²
and Ponisseril Somasundaran¹**

¹Earth and Environmental engineering, 500 W, 120th street, 918 Mudd Columbia University, New York, NY, 10027,

²Biomedical engineering, 351 Engineering Terrace, 1210 Amsterdam Avenue, Columbia University, New York, NY, 10027

One of the main challenges in repair or recovery of articular cartilage is the sustained inflammatory damage of the cartilage tissue. The adverse effects can, at least partially, be suppressed by administering ceria nanoparticles to the engineered articular tissue constructs. However, the relationships between the mechanical properties and biochemical characteristics of the constructs from one side and intracellular molecular processes from another have been unknown as yet. In this study, we employ *in vitro* Raman microspectroscopy of individual chondrocyte cells in 3D agarose scaffolds to find these relationships. We demonstrate the potential of the method in detecting the molecular changes in chondrocytes during the *in vitro* culture in the presence of inflammatory cytokine (interleukin-1 α) and ceria nanoparticles. We discuss possible mechanisms for the observed beneficial effects of ceria nanoparticles.