

# Carnegie Mellon

## Materials Science and Engineering Seminar Series

**Peter K. Davies**

Department of Materials Science and Engineering  
University of Pennsylvania

*“Nano-Chessboard Superlattices formed by Spontaneous Phase Separation  
in Oxides”*

**Friday, November 2, 2007**

**11:00 A.M. Seminar in The Singleton Room**

The use of bottom-up fabrication of nanostructures for nanotechnology inherently requires two-dimensional control of the nanostructures at a particular surface. This could in theory be achieved crystallographically with a structure whose three-dimensional unit cell has two or more tuneable dimensions on the nanometer scale. This talk will describe what is to our knowledge the first example of a truly periodic two-dimensional nanometer-scale phase separation in an inorganic material and demonstrate the ability to tune the unit cell dimensions. The phase separation occurs spontaneously in the homologous series of the perovskite-based Li-ion conductor,  $(\text{Nd}_{2/3-x}\text{Li}_{3x})\text{TiO}_3$ , to give two phases whose dimensions both extend into the nanometer scale. The driving forces responsible for the formation of these unique structures and opportunities for the formation of similar structures with different chemistries will be discussed, together with their potential for application as templates for nanostructure assembly.

*Reference:* Guiton & Davies, *Nature Materials*, 6, 586-591 (2007)

Peter K. Davies is Professor and Chair of the Department of Materials Science and Engineering at the University of Pennsylvania. He received his B.A. degree in Inorganic Chemistry from New College, Oxford University and his Ph.D. in Solid State Chemistry from Arizona State University. His primary interests lie in the synthesis, stability, crystal chemistry and properties of electronic ceramic materials. His areas of focus have included the role of cation ordering reactions in enhancing the resolution of microwave resonators in wireless communication systems, the preparation of new lead-free ferroelectric and piezoelectric materials, and the formation of nanoscale modulated perovskite oxides. Dr. Davies is a Fellow of the American Ceramic Society, and a recipient of the National Science Foundation Creativity Award. He serves on the editorial and advisory boards of several ceramic and solid state science journals and has received several teaching awards from the University of Pennsylvania. He has authored or co-authored 150 refereed publications and served as an advisor to more than 45 graduate students and post-docs.