Outreach Programs

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Cooperative International Science and Engineering Internships

Cooperative International Science and Engineering Internships(CISEI)
Summer 2005 - Student Projects

Student / School	Mentor	Faculty Sponsor	Department	Student Project
Elisabeth Knoche Materials/University of Stuttgart-Germany	Tobias Schaedler	Carlos Levi	Materials	Metastable phase evolution in the ternary system TiO_2-$YO_{1.5}$-ZrO_2
Christian Spiessberger Materials/University of Stuttgart-Germany	Joona Bang, Peter Lowenhielm	Craig Hawker	Materials	Photo-crosslinkable random/block copolymers for nanofabrication

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Elisabeth's Project Page - CISEI summer 2005

Intern: Elisabeth Knoche, Materials, University of Stuttgart, Germany
Mentor: Tobias Schaedler
Faculty Supervisor: Carlos Levi
Department: Materials Department

Metastable phase evolution in the ternary system TiO_2-$YO_{1.5}$-ZrO_2

The ternary system TiO_2-$YO_{1.5}$-ZrO_2 is technologically interesting for application in fuel cells, oxygen sensors and thermal barrier coatings. Since this ternary is not well studied yet, the metastable phase evolution of selected compositions was investigated to improve the understanding of the thermodynamics and kinetics governing the phase selection. The samples were prepared by reverse co-precipitation and then pyrolyzed at 700 celsius for 1h. An amorphous oxide was obtained for many compositions, which was subsequently heat treated at progressively higher temperatures. The results provided insight into the phase evolution sequence and the thermodynamics of the emerging phases. A significant metastable extension of the bixbyite, fluorite and pyrochlore phases was observed. To investigate the equilibrium phase constitution, the samples were additionally subjected to long-term heat treatments. The results of these equilibration treatments were then compared to the calculated phase diagram for purpose of verification or modification.

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Christian's Project Page - CISEI summer 2005

Intern: Christian Spiessberger, Materials/University of Stuttgart-Germany
Mentor: Joona Bang/Peter Lowenheilm
Faculty Supervisor: Craig Hawker
Department: Materials Department

Photo-crosslinkable random/block copolymers for nanofabrication

Manufacturing of devices used for information technology requires control of structures on the nanometer size scale. Current techniques, such as photo lithography, are limited by size of features that can be constructed, which is a consequence of the wavelength of the employed light source. Therefore, alternative methods have been developed. Diblock copolymers are known to self-organize into ordered nanodomains. This property can be used to create specific nanopatterns by simply coating substrates with diblock polystyrene(PS)-polymethylmethacrylate(PMMA) copolymers. The polystyrene block contains a crosslinking moiety (benzocyclobutene, BCB) which is cross-linked by heat. This stabilizes the polystyrene domains by forming a network. After cross-linking the MMA is degraded by UV-light and washed away. The remaining polystyrene network forms the desired nanopattern. In this project we modified this method by replacing the expensive BCB with cheaper chemical components.

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