



## Chemical Engineering Department & Polymer Engineering Program Joint Seminar

Lecture Hall 6, Wolfson Department of Chemical Engineering,

**March 30, 2016, Wednesday, 13:30**

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## Polymer Hybrids

Solutions to global problems including energy conversion and storage, clean water and human health require increasingly complex, multi-component hybrid materials with unprecedented control over hierarchical length scales and local order. This talk will give examples for the rational design of novel functional polymer hybrid materials with hierarchical order from the near-molecular to the meso-scale. These materials are often based on the self-assembly of block copolymer structure directing molecules into polymer-inorganic hybrid materials. Discussion will include formation of porous materials with amorphous, polycrystalline, and epitaxially grown single-crystal structures. Experiments will be compared to theoretical predictions to provide physical insights into formation principles. The aim of the described work is to understand the underlying fundamental chemical, thermodynamic and kinetic formation principles enabling generalization of results over a wide class of materials systems. The talk will cover the formation of hierarchical structures at equilibrium as well as via processes far away from equilibrium. Examples will include the development of dual modality probes (optical/PET) for nanomedicine, mesoporous electrodes for energy conversion and storage devices, as well as the formation of self-assembled superconductors.

### References

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- 2.) K. W. Tan, B. Jung, J. G. Werner, E. R. Rhoades, M. O. Thompson, U. Wiesner, *Transient Laser Heating Induced Hierarchical Porous Structures from Block Copolymer Directed Self-Assembly*, *Science* **349** (2015), 54-58.
- 3.) E. Phillips, O. Penate-Medina, P. B. Zanzonico, R. D. Carvajal, P. Mohan, Y. Ye, J. Humm, M. Gönen, H. Kaliagian, H. Schöder, H. W. Strauss, S. M. Larson, U. Wiesner, M. S. Bradbury, *Clinical translation of an ultrasmall inorganic optical-PET imaging nanoparticle probe*, *Sci. Transl. Med.* **6** (2014), 260ra149.
- 4.) H. Sai, K. W. Tan, K. Hur, E. Asenath-Smith, R. Hovden, Y. Jiang, M. Riccio, D. A. Muller, V. Elser, L. A. Estroff, S. M. Gruner, U. Wiesner, *Hierarchical porous polymer scaffolds from block copolymers*, *Science* **341** (2013), 530-534.
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