MONASH University

Monash Centre for Electron Microscopy

Monash Centre for Electron Microscopy Seminar

New Chemistry: 'Polymeric Micelle Assembly' for Synthesis of Porous Materials with Highly Crystallized Frameworks

MONDAY 5 FEBRUARY, 2018

3:00 pm

Lecture Theatre S2,
16 Rainforest Walk (Bldg 25)
Monash University Clayton Campus

Presenter

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Abstract

Polymeric micelles are formed in solution when the hydrophobic portions are driven to an interior structure while hydrophilic portions are turned outward facing toward the water. Recently, we have focused on the polymeric micelles as stable and rigid templates for obtaining mesoporous materials with ultra large pore sizes. Our 'polymeric micelle assembly' approach is highly useful for preparation of novel mesoporous materials which are not easily obtained by general synthetic approaches. As one example, mesoporous gold (Au) films with tunable pores are expected to provide fascinating optical properties stimulated by the mesospaces, but they have not been realized yet because of the difficulty of controlling the Au crystal growth. Very recently, we reported a reliable synthesis of mesoporous Au films using stable micelles of polystyrene-*block*-poly(oxyethylene) (PS-*b*-PEO) diblock copolymers, with electrochemical deposition advantageous for precise control of Au crystal growth. In the electrolyte solution, $HAuCl_4$ is dissolved into H_3O^+ and $AuCl^{4-}$ ions and then interacts with the EO shells of the micelles through hydrogen bonding. This interaction favours H_3O^+ rather than $AuCl_4^-$, and consequently creates positively charged micelles that can be directed to the working electrode surfaces, where the $AuCl_4^-$ ions are reduced to metallic Au with the electrochemical deposition of the micelles. The resultant mesoporous Au films actually exhibit high scattering performance and thus high activity for molecular sensing. Significantly, enhanced electric field (E-field) amplitude is clearly seen inside or at the perimeter of the mesopores. In this presentation, we would like to develop new mesoporous/nanoporous materials as well.

Selected Publications in 2015-2017: *Nature Commun.*, **8**, 15717 (2017); *Nature Commun.*, **8**, 15581 (2017); *Angew. Chem. Int. Ed.*, DOI: 10.1002/anie.201707878; *Angew. Chem. Int. Ed.*, **56**, 8435-8440 (2017); *Angew. Chem. Int. Ed.*, **56**, 7836 (2017); *Nature Chemistry*, **8**, 638 (2016); *Angew. Chem. Int. Ed.*, **55**, 10037 (2016); *Angew. Chem. Int. Ed.*, **55**, 8426 (2016); *Angew. Chem. Int. Ed.*, **55**, 8228 (2016); *Angew. Chem. Int. Ed.*, **55**, 12746 (2016); *Angew. Chem. Int. Ed.*, **55**, 12793 (2016); *J. Am. Chem. Soc.*, **138**, 13874 (2016); *Nature Commun.*, **6**, 6608 (2015); *Angew. Chem. Int. Ed.*, **54**, 11073 (2015); *Angew. Chem. Int. Ed.*, **54**, 4222 (2015); *Angew. Chem. Int. Ed.*, **54**, 951 (2015); *Angew. Chem. Int. Ed.*, **54**, 588 (2015); *J. Am. Chem. Soc.*, **137**, 11558 (2015); *J. Am. Chem. Soc.*, **137**, 1572 (2015).
Media release (1): http://media.uow.edu.au/releases/UOW233837
Media release (2): http://media.uow.edu.au/releases/UOW232471

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