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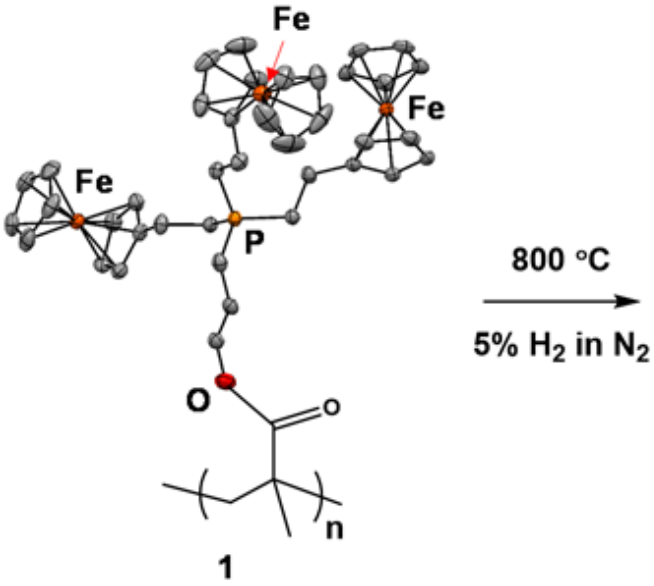
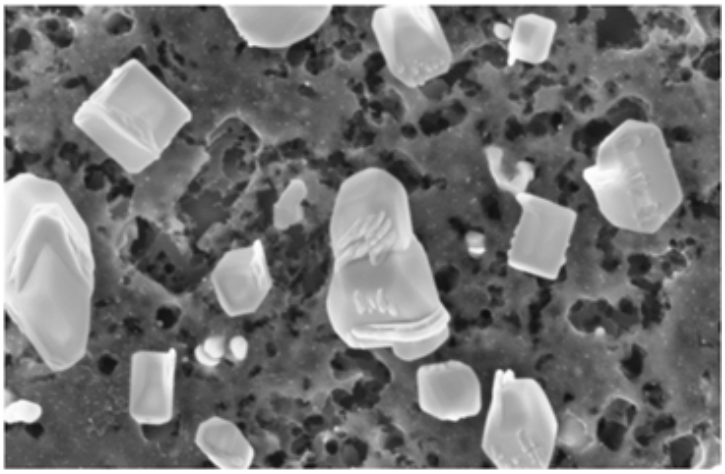
Synthesis of Metal-Rich Nanoparticles from Highly Metallized Phosphonium Polyelectrolytes

Amir Rabiee Kenaree
Department of Chemistry
Western University
London, ON

Metal−containing polymers have emerged over the past two decades as a versatile new class of (multi)functional materials.1 These materials combine the processability of polymers and the highly desirable properties (e.g., redox and catalytic activity, magnetic, light−absorbing) of transition metals and can be used as precursors to nanostructured materials.2 In this context, we have synthesized the first example of metal−containing phosphonium polyelectrolyte 1 and a thin film of this polyelectrolyte was prepared by spin coating of its solution onto a freshly cleaned silicon wafer. The film was later dried and under a steady flow of 5% H2 in N2 heated to 800°C and finally analyzed by scanning electron microscopy (SEM). The resulting images and elemental mapping/analysis experiments revealed a mixture of magnetite (Fe3O4) crystallites and a carbon−, phosphorus−, and oxygen−containing phase. Crucially, a significant quantity of the iron within the polyelectrolytes appears to be retained upon pyrolysis, illustrating the promise of this new class of highly−metallized polyelectrolytes as precursors to functional metal−rich ceramics and/or nanoparticles.3 Building on this results, our future work will focus on the synthesis of mixed−metal containing polymers (metal = Fe, and Ru) and production of alloyed nanoparticles through pyrolysis and/or e−beam lithography.





1. G. R. Whittell, M. D. Hager, U. S. Schubert and I. Manners, Nat. Mater., 2011, 10, 176–188.
2. L. Ren, J. Zhang, C. G. Hardy, S. Ma and C. Tang, Macromol. Rapid Commun., 2012, 33, 510–516.
3. A. Rabiee Kenaree , B. M. Berven, P. J. Ragogna and J. B. Gilroy, Chem. Commun., 2014, 50, 10714–10717.

Amir Rabiee Kenaree, Ph.D. Candidate, Supervisor: Prof. Joe B. Gilroy