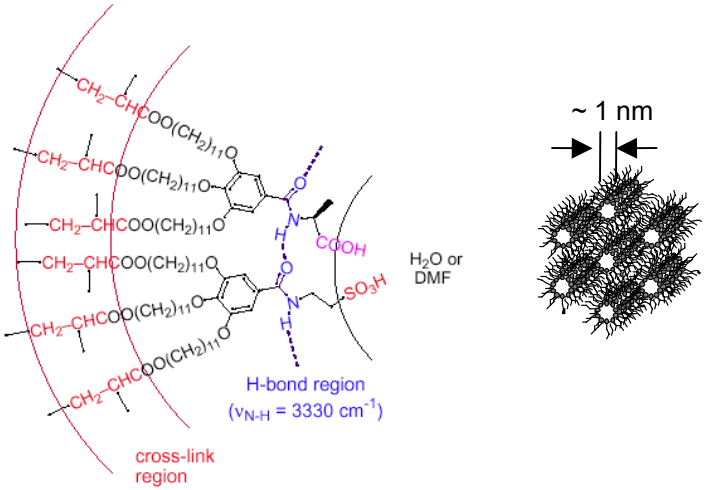
Nanostructured Polymers for Brønsted and Lewis Acid Catalysis via Monomer Self-assembly

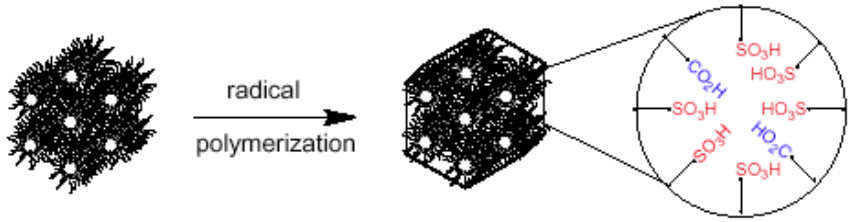
Douglas Gin, University of Colorado at Boulder, DMR-0111193

Heterogeneous acid catalysis is important for many organic transformations in industry and academia. Nanostructured inorganic zeolites are widely used as solid acid catalysts because of their stability and reaction selectivity. Acidic polymer resins (e.g., Nafion, Amberlyst) are also widely used because of their ease of fabrication, but these amorphous catalysts lack the selectivity of zeolitic materials. We present the first example of a catalytic, nanostructured, solid acid resin. This material was made by the templated self-assembly of acidic liquid crystals, and has much higher selectivity than amorphous acid resins in esterification reactions.

Langmuir, **2003**, *19*, 6346; *JACS*, submitted



Hydrogen bond assisted self-assembly of two acidic amphiphiles into a hexagonal liquid crystal phase.



In situ polymerization of the inverted hexagonal assembly into a nanostructured strong acid resin.

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Education:

The goal of my NSF education plan as a 50/50 faculty member in both the Chemistry (CHEM) and Chemical Engineering (CHEN) is to integrate aspects of both disciplines into the courses I teach, so that students in both areas can get a more interdisciplinary perspective. This past year, I taught Polymer Engineering in CHEN, and Physical Organic Chemistry for first-year CHEM graduate students. The Polymer Engineering course was taught with equal emphasis on organic/polymer design and polymer physics/engineering, which is very different from past iterations of the course which focused mainly on the latter topic. Also, four CHEN graduate students working on polymer Ph.D. projects took my CHEM Physical Organic course to get a more interdisciplinary approach to organic chemistry.

Outreach:

I am also worked with the CU Boulder Ferroelectric LC Materials Research Center's outreach program on a teaching module development project funded by the Colorado Commission on Higher Education. The goal was to develop demonstrations suitable for use in high schools to educate students on nanoscale phenomena. We used our LLC polymer technology to generate polymer membranes that can separate different colored dye molecules in water based on molecular size, affording a visually demonstration of nanotechnology in action. In addition, my lab took on an RET researcher to do summer research on nanostructured acid resin catalysts for 6 weeks (Mr. Robert Kerr from Ohio).