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# Self-Assembly of Ultra-High Power Batteries and 3D Optoelectronically Active Photonic Crystals


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**Abstract:** Over the past decade, the sophistication of self and directed-assembly approaches for functional composite structures has increased dramatically, however, application of such structures in real-world systems has remained largely elusive, in part because such structures almost always contain finite defect densities. The storing, generating and harvesting of photons and electrons presents a unique opportunity for self-assembled composite materials. These applications are not only generally much more defect tolerant than for example self-assembled computational electronics, but also for these areas to make a substantive impact on the world energy situation, they must be produced in exceptionally large volume. In my talk, I will attempt to capture the state-of-the-art in highly functional self-assembled three-dimensional composites for energy harvesting and storage illustrated with examples from both my research and other groups with a particular focus on high charge and discharge rate nanostructured electrochemical energy storage systems (batteries and supercapacitors), and photonic crystals which exhibit unprecedented control over the absorption and emission of light (lasers, LEDs, and solar cells). If time permits, I will also give a vignette from our work on mechanochemistry (mechanically induced chemical reactions).


**Biography:** Paul V. Braun is the Ivan Racheff Professor of Materials Science and Engineering at the University of Illinois at Urbana-Champaign. His research focuses on the synthesis and properties of 3D architectures with a focus on materials with unique optical, electrochemical, thermal, and mechanical properties. Prof. Braun received his B.S. degree with distinction from Cornell University in 1993, and his Ph.D. in Materials Science and Engineering from Illinois in 1998 before he joined the faculty in 1999. Prof. Braun has co-authored a book, authored over 100 peer-reviewed publications, and has been awarded multiple patents. He is the recipient of the Young Alumnus Award (2011), the Friedrich Wilhelm Bessel Research Award (2010), the Stanley H. Pierce Faculty Award (2010), Beckman Young Investigator Award (2001), a 3M Nontenured Faculty Award, the 2002 Robert Lansing Hardy Award from TMS, the Xerox Award for Faculty Research (2004, 2009), and multiple teaching awards.