ABSTRACT: The ability to fabricate molecularly tailored interfaces with nanoscale precision offers means to selectively modulate charge transport, molecular assembly, and exciton dynamics at hard matter-soft matter and soft-soft matter interfaces in advanced polymer solar cells. Such interfaces can facilitate transport of the “correct charges” while blocking transport of the “incorrect charges” at electrode-active layer interfaces. This interfacial tailoring can also suppress carrier-trapping defect densities at interfaces and stabilize them with respect to physical/thermal de-cohesion. For soft matter-soft matter interfaces, interfacial tailoring can also facilitate exciton scission and photocurrent generation in such cells. In this seminar, challenges and opportunities in molecular photovoltaic interface science are illustrated. It will be seen that such rational interface engineering along with improved bulk-heterojunction polymer structures guided by theoretical/computational analysis, affords exceptional fill factors, solar power conversion efficiencies greater than 10%, and enhanced solar cell durability.

BIOGRAPHY: Tobin Marks is Ipatieff Professor of Catalytic Chemistry, Professor of Materials Science, and Professor of Applied Physics at Northwestern University. His recognitions include the U.S. National Medal of Science, the Princepe de Asturias Prize, the MRS Von Hippel Award, the Dreyfus Prize in the Chemical Sciences, and the National Academy of Sciences Award in Chemical Sciences. He is a member of the U.S., German, and Indian Academies of Sciences, the US National Academy of Engineering, the American Academy of Arts and Sciences, and the US National Academy of Inventors. He is a Fellow of the Royal Society of Chemistry. Marks has published 1225 peer-reviewed articles and holds 234 issued U.S. patents. Degrees: B.S. from the University of Maryland and Ph.D. from MIT.