Abstract. The skyrocketing energy demand and growing urgency to limit anthropogenic strains on our health and environment have created a need for smart materials that can generate energy from clean and renewable sources, capture and detect pollutants and toxic chemicals, improve the energy efficiency of future electronic devices, deliver drugs in our bodies in a controlled fashion, and help sustain a myriad of other technological advances. With a long-term goal to meet these demands, we have been developing new functional materials that can carry out these functions through their interactions with various external stimuli, such as guest molecules and ions, applied electric field, and light. In this talk, I will describe how we have been able to (i) discriminate anions based on their intrinsic electronic and solvation properties using π-acidic and Lewis acidic receptors that engage them in tunable electronic interactions, (ii) convert light into electricity using multichromophoric solar cells made of supramolecular light-harvesting arrays, (iii) fine-tune electrical conductivity of semiconducting metal-organic frameworks by infiltrating them with electroactive guests, and (iv) covert self-assembled vesicles into nanotubes by changing the pH of the medium so that they can function as controllable delivery systems.

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