Understanding and Controlling Charge, Heat, and Spin at Atomically Precise Interfaces

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One of the key advances in nanoscience and nanotechnology has been our increasing ability to reach the limits of atomically precise structures. By having developed the "eyes" to see, to record spectra, and to measure function at the nanoscale, we have been able to fabricate structures with precision as well as to understand the important and intrinsic heterogeneity of function found in these assemblies. The physical, electronic, mechanical, and chemical connections that materials make to one another and to the outside world are critical. Just as the properties and applications of conventional semiconductor devices depend on these contacts, so do nanomaterials, molecular assemblies, many nanoscale measurements, and devices of the future. We explore the important roles that these contacts can play in preserving key transport and other properties. Initial nanoscale connections and measurements guide the path to future opportunities and challenges ahead. Band alignment, minimally disruptive connections, and control of spin and heat are all targets and can be characterized in both experiment and theory. I discuss our initial forays into this area in a number of materials systems.

Bio

Paul S. Weiss is a nanoscientist and holds a UC Presidential Chair and is a distinguished professor of chemistry, bioengineering, and materials science at UCLA. He studies the ultimate limits of miniaturization, developing new tools and methods for atomic-resolution and spectroscopic imaging and chemical patterning. He applies these advances in other areas including quantum information, sensing, neuroscience, microbiome studies, tissue engineering, cellular therapies, and high-throughput gene editing. He has won awards in science, engineering, teaching, publishing, and communications. He is a fellow of the American Academy of Arts & Sciences, AAAS, ACS, AIMBE, APS, AVS, Canadian Academy of Engineering, Chemical Research Society of India, Chinese Chemical Society, IEEE, and MRS. He was the founding editor-in-chief of *ACS Nano*.