

IV. Materials, Fabrication and Integration for Sensor Architectures

(C1) Chemically-Synthesized and Biologically-Inspired Architectures

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The last century witnessed the metamorphosis of silicon, an element common in the Earth's crust, into silicon integrated circuits (ICs), complex superstructures that contain hundreds of millions of transistors in a tiny footprint. This rock-to-IC transformation that culminated in computer microprocessors was made possible by what many call top-down fabrication approach, where silicon is chiseled down to the small structures.

While the dominance of this enormously fruitful fabrication paradigm will undoubtedly last into the foreseeable future, efforts to enable the opposing, bottom-up fabrication paradigm are burgeoning. In the bottom-up approach, devices are constructed upward in size using chemical synthesis, starting from the molecular level. The bottom-up approach is well suited for growing high-quality low-dimensional nanoscale devices (e.g., semiconductor nanowires, carbon nanotubes, nanoparticles). These nanoscale devices have excellent electronic transport properties due to their inherently low electron scattering, and as such, they stand at the heart of the current nanoelectronics endeavor. Also their size scale allows them to be used as potentially excellent sensors to detect nanoscale objects, including biomolecules such as virus particles, cancer marker proteins, and DNA, and thus, the expansive field of biosensing using nanoscale devices. Finally, one can assemble the nanoscale devices into a complex structure by mimicking diversity and high selectivity of biological interactions.

This session presents some representative works in chemically-synthesized and biologically-inspired architectures. Construction of complex circuits and multiplexed biosensors using chemically synthesized nanoscale devices and various ingenious assembly processes (assembly mimicking diversity and high selectivity in biological interactions, fluid driven assembly, or assembly exploiting highly selective chemical interactions) and experimentations with them will be included.