Spintronic Devices Prepared by Atomic Layer Deposition

The phenomenal annual improvement in speed and density of conventional electronic circuits, commonly known as Moore's Law, is likely to confront fundamental physical limits within the decade. In order to continue improving the power of information processing circuits, fundamentally different logic devices will have to be introduced. Of several candidate technologies, devices that use spin state of electrons to carry and process information have been considered among the most viable alternatives to succeed conventional charge-based electronics when these reach their ultimate scaling limits.

We are developing new technologies for fabrication of nanostructured spintronic devices and the evaluation of these devices for computational logic applications. Our research is investigating both metal-insulator-metal (MIM) ferromagnetic tunnel junctions and metal-insulator-semiconductor (MIS) tunnel junctions for injection of spin polarized electrons into silicon. The key enabling technology will be the development of atomic layer deposition (ALD) for fabrication of ultra-thin spin-filtering MgO tunnel barriers. We will measure the spin dependent transport through the MIM and MIS structures and analyze novel reconfigurable logic devices based on these structures.

Supported by: ONAMI-ONR
Investigators: Dr. Jander and Dr. Dhagat, OSU
Dr. Solanki, PSU