Researchers at the University of South Florida have invented a novel fabrication method which is capable of mass producing Metal-Insulator-Metal (MIM) diodes with junction areas on the order of 0.01μm^2 through a combination of UV photolithography and wafer polishing techniques.

A MIM tunneling diode having a response time of less than a picosecond has the potential to outperform common semiconductor counterparts. Particularly with regard to mixing and detection of terahertz and infrared radiation. One of the key challenges for manufacturing such devices is the need for nano-scale junction size, having an area on the order of 0.01μm^2. For achieving, the desired junction sizes, e-beam lithography has been commonly used in prior research efforts. However, e-beam lithography is a slow “direct-write” nanolithography method, and is not amenable for low-cost volume production.

USF inventors have developed a new CMOS-compatible process that is suitable for mass production of MIM tunneling diodes with sub-micron sized junction. Through a strategic combination of standard UV photolithography, regular wafer polishing techniques, and atomic layer deposition (ALD), MIM diode nano-scale junctions can be readily manufactured for volume production.

ADVANTAGES:
- Economical volume production
- Simplified and scalable manufacturing process
- IC/MEMS fabrication foundry accepted

SIMPLE Fabrication of Nano-Scale MIM Junctions

MIM nanoscale junction in (a) cross-sectional view; and (b) top view.