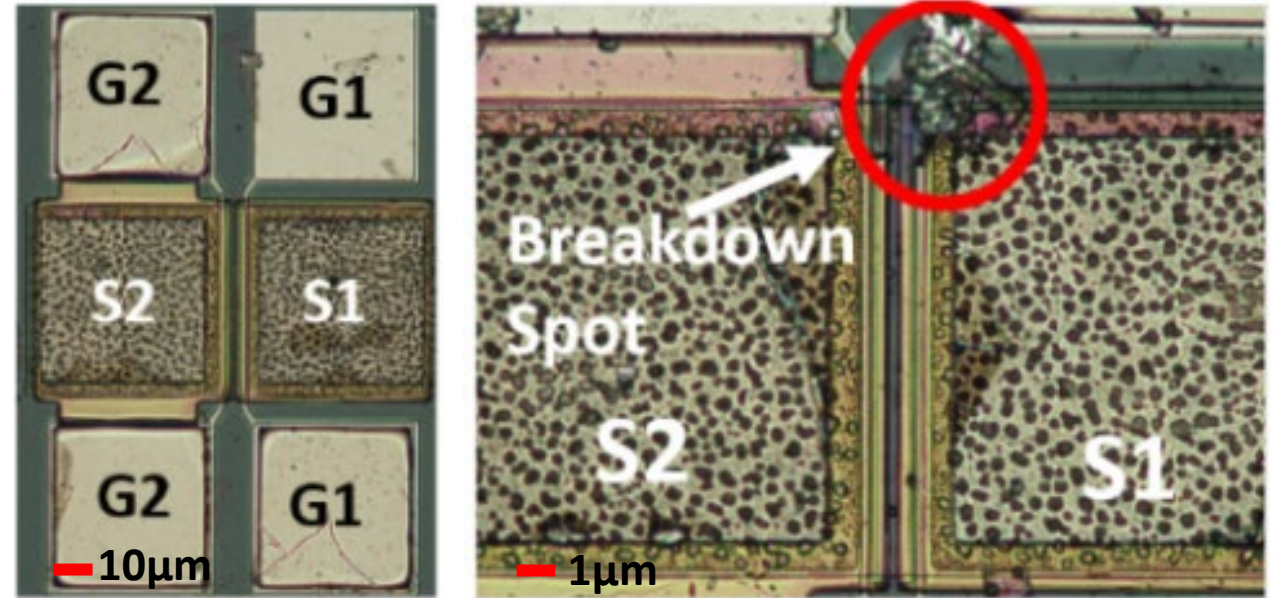


A new class of high voltage transistors called bidirectional transistors which can conduct large currents when on and block large voltages when off are needed for automotive and grid applications. Wide bandgap semiconductors like gallium nitride (GaN) are much better for these applications than silicon, but they pose materials challenges in fabrication and integration with other materials like insulators.

Wisconsin MRSEC researchers have designed and fabricated a new dual-gate 1200 V GaN based bidirectional transistor with good performance. However, performance is limited by failure of the electrically insulating layer, which is currently amorphous silicon nitride (SiN), a conventional material. In the next generation of devices, the team has replaced SiN with a crystalline strontium titanate membrane (SrTiO_3) developed by MRSEC IRG 2. SrTiO_3 is a much better insulator, so the team expects record performance in ongoing device testing.



(left) Optical microscope image of a dual-gate/dual-source bidirectional transistors. (right) Optical microscope image of a device that failed in the SiN insulating layer. Replacing SiN with a better material like SrTiO_3 will significantly increase the device's efficiency in power conversion.