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Silicon Carbide: The Next Step Beyond Silicon?

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Silicon carbide (SiC) is a binary compound semiconductor that offers the possibility of much higher performance than silicon in selected applications. As a material, SiC is extremely robust. Second in hardness only to diamond, SiC has been used for years as a coating on saw blades and drill bits. It is so thermally stable that some of the processing temperatures needed to fabricate electronic devices are above the melting point of silicon. SiC is impervious to all known room temperature chemical etchants, and its bonding strength is so great that carrier generation due to thermal breaking of covalent bonds is *eighteen orders-of-magnitude* slower than in silicon.

Commercially available as 75 mm diameter wafers, SiC has been used to fabricate a variety of electronic devices including both bipolar and MOS power transistors, microwave devices, and small-scale integrated circuits. This talk will survey some of the more important device demonstrations to date, highlight the remaining technical challenges, and assess the prospects for displacing silicon in selected applications.

Biography of James A. Cooper

James A. Cooper is the Charles William Harrison Professor of Electrical and Computer Engineering at Purdue University. He received his BSEE from Mississippi State University in 1968, his MSEE from Stanford in 1969, and his Ph.D. from Purdue in 1973. From 1973 to 1983 he was a member of technical staff of Bell Laboratories, Murray Hill, NJ, where he was principal designer of AT&T's first microprocessor and developed a time-of-flight technique for investigating high-field transport in silicon inversion layers. He joined the faculty of Purdue University in 1983, where he became the founding director of the Purdue Optoelectronics Research Center. He served as Associate Editor of *IEEE Transactions on Electron Devices* from 1983 through 1986, and was guest editor of the 1999 special issue of *IEEE Transactions on Electron Devices* on SiC device technology. He has co-authored over 250 technical papers and conference presentations, 5 book chapters, and holds 13 US patents. He was elected Fellow of the IEEE in 1993, and currently serves as a member of the editorial advisory board of *IEEE Proceedings*. He is Co-Director of the Birck Nanotechnology Center, a \$58 million research facility being constructed in Purdue's Discovery Park.