# Silicon Carbide Crystal Growth and Applications, History and Current Status

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Andy Souzis received his Ph.D. in Physics from Stevens Institute of Technology in 1990 and has over 25 years of experience in semiconductor (and other) materials and crystal growth. He began his career as a National Research Council Post-Doctoral Research Fellow at the U.S. Army Research Lab followed by a Senior Materials Scientist position at IBM. From 1994 to 2001 he worked as the Crystal Growth R&D Program Manager at Litton-Airtron and was a key contributor in the development of the industry's first 150 mm GaAs crystal growth manufacturing line. From 2001 to the present he has worked at II-VI where he is currently Business Development Director of the Advanced Materials Division. His activities have focused on technology, manufacturing and business development as the division has grown from a technology start-up to a global leader in the SiC substrate market. He has managed over $50M in US Government programs focused on SiC substrate development, through agencies including Title III, AFRL, DARPA and MDA. He holds 5 SiC crystal growth patents and has authored over 100 publications in scientific journals and international conference proceedings.


### Abstract

Because of the advantageous physical and electronic properties of SiC as compared to Si, which today makes up the vast majority of power electronics manufacturing, SiC substrates today have begun to enable the foundation for a new generation of high performance, high efficiency power devices. The outlook and market demand for SiC based power devices and the systems based on them are experiencing dramatic growth. This current successful status has however, taken years of technology and process development to overcome fundamental material and quality barriers to large scale manufacturing.

This talk will discuss the fundamentals of SiC crystal growth, wafer fabrication and polishing, both from a technology standpoint as well as volume manufacturing. Topics covered will include discussion of the PVT (Physical Vapor Transport) technique that is the basis for all of today’s volume manufacturing. With a Mohs hardness of between 9 and 9.5, SiC is one of the hardest materials known. As a result, SiC fabrication and polishing presents significant difficulties compared to traditional high volume semiconductor materials. These manufacturing techniques will be reviewed. Types of wafer defects such as micropipes and dislocations, their improvement over the years, as well as the status of other bulk and wafer surface properties and characterization methods will be also be discussed.