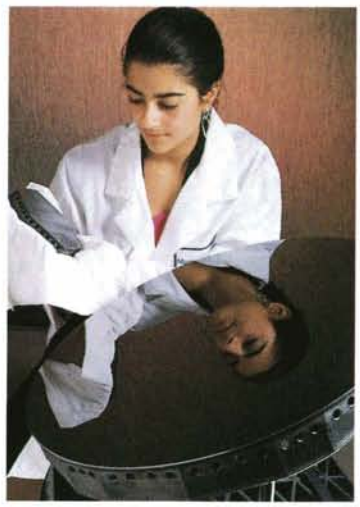
Mirror Technology

LIDAR (light detection and ranging) is a technique employed by NASA and other research organizations for remote measurement of atmospheric characteristics. The performance of a spacecraft-based LIDAR system depends in great measure on the efficacy of the primary mirror in the system's receiving telescope. Seeking to improve LIDAR mirrors, Langley Research Center awarded a contract to CVD Incorporated, now a subsidiary of Morton International (MI-CVD), Woburn, Massachusetts, for development of lightweight silicon and silicon carbide mirrors for space-based LIDAR applications.

Silicon carbide (SiC) is a material used in many high temperature engineering applications, such as furnace components in semiconductor processing chambers. However, SiC produced by traditional methods cannot be optically polished to the high degree of surface finish needed for LIDAR mirrors. MI-CVD developed a process for producing bulk SiC by means of a chemical vapor deposition (CVD) process; this technology allows growth of a high purity material with superior mechanical/thermal properties and high polishability, making it ideal for mirror applications. MI-CVD employed the technology in developing three research mirrors for NASA-Langley, which were delivered in 1990.

MI-CVD is now marketing the technology for space, military and commercial applications under the trade name CVD SILICON CARBIDE™. In the **photo above** is an assortment of the company's mirror products, illustrating how the mirrored surface can be polished for various applications from very high reflectivity to a seemingly dull finish. **Above**, a technician is finishing a large, half-meter-diameter SiC mirror; the mirrors can be produced in sizes ranging from a few centimeters in diameter to 1.5 meters.



CVD SILICON CARBIDE offers advantages in the space-based mirror market because of its light weight, high stiffness and thermal stability; it does not display the thermal distortion sometimes experienced with other materials. Its high reflectivity and thermal properties offer advantages for its use in synchrotron (nuclear research) facilities and it is also generating interest among industrial users of high power lasers. In industrial use, the optics of the laser are often exposed to dust, dirt and welding slag. The hardness of CVD SILICON CARBIDE allows an uncoated optic to be easily wiped clean without damage to the surface. A coated SiC optic offers another advantage: when the coating becomes damaged, the entire optic can be acid-dipped to prepare for application of a new coating, eliminating the time-consuming and costly step of refurbishing the substrate. ●

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