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COVER Optical image of a 6.0-micrometer-thick single-crystal diamond film grown by chemical vapor deposition, together with gem-cut natural diamonds. Strain in the crystal causes the various colors in polarized light. Such films may form the basis for new kinds of electronic and optical devices. See Editorial, page 1637, and Molecule of the Year, p. 1640. [Diamond film made by A. Badzian and T. Badzian, micrograph by Barry Scheetz, Pennsylvania State University, University Park, PA 16802; photograph of gem-cut diamonds by Randy Duchaine/The Stock Market]

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The Molecule of the Year

Diamonds may soon be everyone's best friend. According to enthusiasts, synthetic diamonds have already or will soon appear on watch crystals, eyeglasses, optical instruments, audio speakers, fuel injection nozzles, turbine blades, scalpels, and semiconductor wafers, to name only a few applications.

The remarkable properties of diamond were recognized long ago. The name originates from the Greek *adamas*, which means invincible. Diamonds, particularly large ones, are among the most desirable gemstones, but the scientific and industrial value of diamond films and small diamonds is perhaps even more striking. For hardness, for electrical resistance, for corrosion resistance, and for thermal conductivity, diamonds are at the extreme. Diamond also absorbs less light at most wavelengths, and also exhibits ten times greater thresholds to laser damage. Its thermal properties can be improved even further by making pure carbon-12 isotopic diamonds. Diamond circuits could be more stable and would remove accumulated heat more rapidly than the silicon wafers that are the current core of the semiconductor industry.

Last year a new feature, the Molecule of the Year, was initiated by *Science* with the idea of honoring the scientific development of the year most likely to have a major impact on scientific advances and societal benefits [*Science* **246**, 1541 (1989)]. The condition for selection was not that the development had to be discovered in the year of the choice, but rather that in that year the accumulation of experience and expertise indicated that the discovery was on a pathway of major importance. The polymerase chain reaction was picked as the Molecule of the Year for 1989, and the exponential increase in 1990 in its use in the laboratory, in industry, and in the courtroom supports that selection. Diamonds in 1990 seem to be at the equivalent stage. There are cost factors and theoretical problems to overcome, but the mounting excitement in conferences, journals, and industrial laboratories indicates that the threshold in the development of a new technology has been passed. A more detailed account of the diamond development, and of the runner-up candidates for Molecule of the Year, is given on page 1640 of this issue.

One of the intriguing aspects of the synthetic diamond technology is its relation to the discipline of materials science. That area of modern science, a child of physics, engineering, and chemistry, has flourished enormously in recent years, producing such practical applications as transistors, superconductors, and designer catalysts. Materials science has a history of symbiosis between academe and industry and is driven by the interplay between fundamental research and practical applications. Materials scientists constantly search for new phenomena and new combinations of existing properties. These discoveries can lead to previously unimaginable technologies or can decrease the cost of existing applications so that they become accessible to a wider range of problems. This is one of the reasons materials scientists are so excited about thin diamond films. They will now be able to exploit the incredible properties of diamond in situations that were discarded as impractical in the past. For example, electronic devices in which diamond forms the substrate, or backbone, for the device would be inconceivable without the ability to grow diamond as a film. Moreover, materials scientists are aware that knowledge diffuses like ions hopping in a lattice, so that other promising materials, such as boron nitrides, will benefit from the new science revealed by diamond studies.

As we watch the sudden rise in expectations and knowledge of diamonds, do we need to fear side effects of unknown consequence? No obvious difficulties are apparent, other than the economic readjustments usually accompanying any new technology. Electromagnetic radiation, antibiotics, and transistors are only a few of the scientific discoveries that have spawned new industries and enriched all our lives. That they have in turn created new societal problems should lead neither to cries of dismay nor shouts of alarm. Who really wants to get rid of television sets, life-saving drugs, or computers? Synthetic diamonds may well create new problems requiring new science and new ingenuity, but the potentialities for new frontiers more than outweigh the possible adversities.

Scientists who say, "The solution to problems created by science is more science," must expect to be viewed with a certain amount of skepticism by the general public. Scientists must therefore do their best to predict in advance that the mainline benefits are likely to outweigh the sideline problems, in which case the public will find that science, like diamonds, can be everybody's best friend.—DANIEL E. KOSHLAND, JR.

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