











ROBERT R. McCORMICK SCHOOL OF ENGINEERING AND APPLIED SCIENCE

## Carbon Nanotube Synthesis: Carbon Arc Discharge

A BIG SPARK In 1992 Thomas Ebbesen and Pulickel M. Ajayan of the NEC Fundamental Research Laboratory in Tsukuba, Japan, published the first method for making macroscopic quantities of nanotubes. It is almost Frankensteinian in its design: wire two graphite rods to a power supply, place them millimeters apart and throw the switch. As 100 amps of juice spark between the rods, carbon vaporizes into a hot plasma (*right*). Some of it recondenses in the form of nanotubes.

Typical yield: Up to 30 percent by weight Advantages: High temperatures and metal catalysts added to the rods can produce both single-walled and multiwalled nanotubes with few or no structural defects. Limitations: Tubes tend to be short (50 microns or less) and deposited in random sizes and directions.



P. G. Collins and Ph. Avouris, Scientific American, 283, 62 (2000).

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