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Research Highlights

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Carbon nanotubes: Blacker than black

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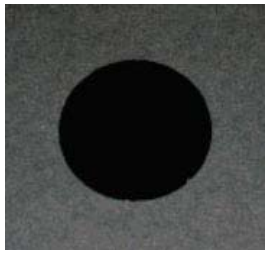
Assembling long carbon nanotubes vertically in a low-density array has resulted in a near-ideal black material that may have light-harvesting applications



An ideal black object absorbs all light and reflects none. Until now, the darkest material ever made, a nickel–phosphorus alloy, reflects 0.16–0.18% of the light that hits it at right angles. At larger angles, however, the reflectance becomes significantly greater and, therefore, it is less useful as an optical absorption material. Previous theoretical predictions have suggested that low-density vertically aligned arrays of carbon nanotubes (CNTs) can be engineered to have very low reflectance, and researchers in the US now report the first experimental evidence that such CNT forests can produce a near-perfect dark object.

Shawn-Yu Lin and colleagues[1 (#B1)] from Rensselaer Polytechnic Institute in New York grew vertically aligned CNT films — with a very low density of nanotubes — using a conventional chemical vapour deposition method. Scanning electron microscopy images of the films revealed that the nanotubes entangled to form a loosely connected porous network, with randomly corrugated surfaces — a combination that makes this an ideal black object. The total reflectance of the CNT film was 0.045%, which is two orders of magnitude lower than glassy carbon and three times lower than the nickel–phosphorus alloy, making it the darkest man-made material ever.

Theoretical calculations suggest that the surface roughness may be important in diffusing the light at all angles. Though the mechanism remains unclear, this black material could have various applications in harvesting solar energy.

REFERENCE

1. Yang, Z.-P., Ci, L., Bur, J. A., Lin, S.-Y. & Ajayan, P. M. Experimental observation of an extremely dark material made by a low-density nanotube array. *Nano Lett.* doi: 10.1021/nl072369t (2008). | **Article** (http://dx.doi.org/10.1021/nl072369t) |