MATERIAL WITNESS

Black diamonds

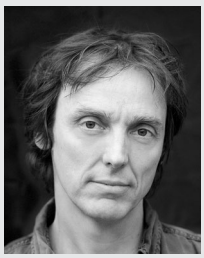
In the early twentieth century, chemist Lloyd Inwood created an absolutely black paint, which absorbed all light that fell onto it. He then coated himself in this material, so that nothing of him was visible except a sort of vague shadow.

Needless to say, this is pure fiction. It's the scenario of Jack London's short story 'The Shadow and the Flash' (1903), in which Inwood pits his invisibility scheme based on total light absorbance against that of his rival Paul Tichlorne, who achieves it with slightly refractive transparency. And of course, perfect blackness does not truly render an object invisible. A coating of this kind instead gives it the aspect of an unearthly void, seemingly devoid of all surface topography, as if a hole has been cut out of spacetime. That was the appearance of the 16.78-carat, US$2 million diamond loaned by jeweller L. J. West for an art project called *The Redemption of Vanity*, once it was coated with a forest of vertically aligned carbon nanotubes created by MIT researchers Brian Wardle and Kehang Cui for MIT's artist-in-residence Diemut Strebe. The diamond was placed on display in September at the New York Stock Exchange. Whether this demonstration of how to make vast wealth 'vanish' created unease on the trading floor is not recorded.

This is not the first time that a highly non-reflective, black carbon-nanotube coating has found its way into art. In 2016, British artist Anish Kapoor secured sole rights to artistic use of a similar material dubbed Vantablack, made by Surrey NanoSystems in the UK. But the new MIT material is blacker still: it absorbs 99.995% of all incident visible light, compared to Vantablack's 99.965%.

The collaboration offers an unusual instance of how the artistic element of an art–science collaboration fed back into the science. Wardle and Cui were initially developing nanotube coatings to influence thermal and electrical rather than optical properties, and it was the independent project with Strebe that inspired them to look more deeply into the reflectance. The two researchers were attempting to produce the nanotube coating on aluminium, but found that deposition was hindered by an oxide layer. Only when Cui discovered that it could be etched away with salt water did the nanotube film grow properly — darkening the surface, and also blocking the subsequent oxide passivation that would otherwise lower the interfacial conductance[1]. Non-reflective (and robust) surface coatings like this could be useful in optical engineering, for example to reduce glare and stray light in space telescopes.

The absolute blackness of the nanotube coating covering the brilliant transparency of the diamond presents about as extreme a contrast of opposites as you could imagine in a single pure element. (Or almost pure; nitrogen impurities give the diamond a yellow cast.) Strebe, who has previously used techniques from synthetic biology in her art, regards it as an expression of the notion propounded by the Greek philosopher Heraclitus that every element is connected to its opposite. It wasn't easy finding someone willing to let her make their diamond 'disappear', however — her request was turned down by De Beers, Cartier and Tiffany before New York-based L. J. West offered the Australian gemstone. How much of the message gets across to the audience at the stock exchange is another matter. "The bankers always ask about the price of the diamond", Strebe has said. ❐



Philip Ball

Published online: 20 November 2019
https://doi.org/10.1038/s41563-019-0551-9

References

1. Cui, K. & Wardle, B. L. *ACS Appl. Mater. Interfaces* **11**, 35212–35220 (2019).