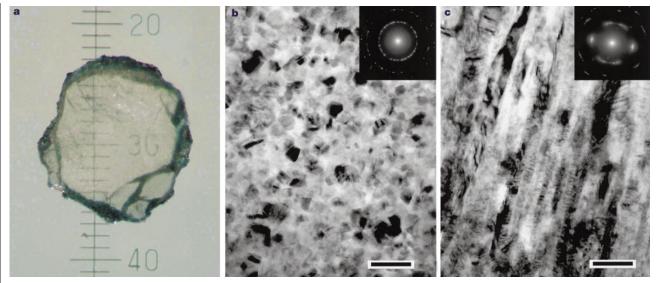**Figure 1** Sintered polycrystalline diamond synthesized by direct conversion of graphite. **a,** Optical microscopic image of a sample of the synthesized diamond (about 0.1 mm in diameter and 0.3 mm thick). **b, c,** Transmission electron microscopy reveals that this diamond material consists of minute crystals that are 10–20 nm across (**b**) and of larger, elongated (100–200 nm) crystals, which are evident in another region of the same sample (**c**). Scale bars, 50 nm. Insets, electron-diffraction patterns of each crystal type, obtained using a beam size of 400 nm.

12–25 gigapascals (GPa). X-ray diffraction and Raman spectroscopic measurements showed that this phase was pure cubic diamond. At lower temperatures (1,600–2,200 °C), a mixture of cubic and hexagonal diamonds, with a small amount of compressed graphite[2], was formed, which was opaque and dark grey in colour.

We studied a thin section taken from a transparent diamond sample (Fig. 1a) using a transmission electron microscope. The sample was seen to consist of very fine granular crystals, which were typically 10–20 nm across; electron diffraction indicated that these were randomly oriented (Fig. 1b). In other parts of the same sample, we observed elongated crystals of up to 100–200 nm in length that had a lamellar texture (Fig. 1c).

We measured the hardness of one opaque and two transparent samples, using a pure synthetic single-crystal diamond as a reference[3]. The transparent samples were found to have Knoop hardnesses of 110–130 GPa and 120–140 GPa, respectively, at several arbitrarily selected points, whereas the opaque sample was less hard (70–95 GPa).

Although diamond is the hardest known material, the Knoop hardness of single-crystal diamond varies from about 60–120 GPa, depending on the crystallographic plane and direction of measurement[4]. Our polycrystalline diamond is therefore as hard as (or even harder than) single-crystal diamond; moreover, this hardness is constant throughout the sample, unlike single-crystal diamond.

Previous attempts have been made to synthesize sintered polycrystalline diamond from graphite either by shock compression or by using static high pressure, but these were unsuccessful, mainly because the reaction time was too short and/or sample heating was not homogeneous[5–8]. Sintering diamond powders to produce a single large diamond also failed, because of heterogeneous stress distribution within the sample as a result of the extreme hardness of the raw diamond[9].

Pure polycrystalline diamond has been produced previously by chemical-vapour deposition, but in a thin film and over several months to obtain millimetre-sized samples (see, for example, ref. 10). These diamonds were not sintered and had poor intergrain adhesion; the crystals were much larger than ours and their orientation was higher. They were accordingly less tough, with a hardness of 80–100 GPa (ref. 10).

Hard, sintered polycrystalline diamond is produced commercially by using a binder of metal or inorganic material[11,12], but this method reduces the hardness of the product to about 50–70 GPa. These sintered diamonds can be used only at temperatures of up to 600–700 °C — particularly in the presence of metal binders, which help diamond to transform back to graphite at ambient pressure. As our polycrystalline diamond is stable up to about 1,200 °C in an inert atmosphere, its hardness should exceed that of binder-containing polycrystalline diamond at high temperatures.

Improving the synthesis of the ultrahard polycrystalline diamond described here could give rise to better-quality products and to new industrial applications, for example in scientific instruments that operate at high pressure. A better understanding of the process by which our diamond is formed should also provide insight into the enigmatic origin of natural polycrystalline diamonds[13].

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correction
Memory enhancement in early childhood
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In emphasizing references pertaining to brain maturation rather than to behavioural development, our brief list implied that this study was the first to demonstrate the emergence of long-term memory for events in infants. On the contrary, a large body of work published by P. Bauer, among many others, addresses this issue exactly and also forms the basis of the methodology developed for our study. Our contribution was to assess retention in children at three different ages after a four-month delay in order to test the *a priori* prediction, based on earlier studies of brain maturation, that nine-month-olds would be compromised relative to children in their second year. More extensive citation of work in this area was not possible because of the limited number of references permitted.