Phononic crystals can also act as superlenses that can focus sound due to the fact that they allow for the phenomenon of negative refraction. These superlenses can produce images that contain details finer than the wavelength of the original wave.

Cheng *et al.* first organized polystyrene spheres by lifting a glass substrate from an aqueous colloidal suspension. This causes them to self-assemble in the face-centred-cubic array. The size of the spheres used (256 nm) guarantees operation in the hypersonic range. After the drying of the structure was complete, one of the samples was infiltrated with silicon oil. Two samples, one dry and one infiltrated, were examined by Brillouin light scattering. This technique measures photon–phonon interactions to reveal the propagation direction and frequency of phonons. Brillouin light scattering has enormous advantages over simple transmissivity or reflectivity measurement methods that are commonly used to characterize photonic crystals in that it allows the complete phonon dispersion to be measured directly. Cheng *et al.* were able to obtain, with outstanding resolution, the band diagram — which shows the frequency regions where sound can and cannot propagate through the crystal — corresponding to the infiltrated sample. In phononic research it is common to focus attention on achieving large bandgaps. Indeed, the position and the width of the bandgap are the critical performance parameters for devices that reflect or localize acoustic waves. However, properties of propagation bands are often just as important. For example, it was recently demonstrated theoretically that negative refraction of acoustic waves can be realized in two-dimensional phononic crystals[4], which is a critical step for making acoustic superlenses for ultrahigh-resolution acoustic imaging. Yet the phenomenon of negative refraction is possible owing to the modification of the properties of propagation bands, and not because of the existence of bandgaps. The significance of the work by Cheng *et al.* therefore lies not only in the clear demonstration of hypersonic bandgaps, but also in the measurements of the detailed shapes of propagation bands. Moreover, they report on the modification of the phonon band diagram on infiltration of colloidal crystals with various liquids. The presence of liquids modifies the mechanical contrast between spheres and intersphere spaces, and therefore alters the features of the band diagram. The position and the width of the bandgap can therefore be tuned by choosing various infiltration liquids.

The work by Cheng *et al.* improves the prospects of realizing three-dimensional periodic structures with phononic bandgaps at frequencies that promote interaction with light. The hope is that hypersonic phononic crystals will enable integrated management of acousto-optical devices. Furthermore, as the length scales of the structures are further reduced, phononic crystals may also control phonons with higher frequencies such as those corresponding to thermal motion.

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MATERIAL WITNESS

Diamond dreams

When Robert Hazen, geoscientist at the Carnegie Institution of Washington, called his 1993 book on high-pressure research *The New Alchemists*, it was tempting to see this as yet another flippant use of 'alchemy' to describe any transformation of matter. But Hazen's evocation of alchemy in a story of the high-pressure synthesis of diamond at the General Electric laboratories in the 1950s could hardly be more apt.

For making artificial diamond is the contemporary equivalent of the alchemical quest for gold — and so diamond synthesis has a resonance that goes far beyond its practical utility. It provides an illustration of how seemingly innocuous research can take on an unguessed significance when embedded in a broader cultural context.

Joachim Schummer (Technical University, Darmstadt) has explored the links between diamond-making, alchemy and the public image of the scientist in an analysis of the 19th-century literary roots of the 'mad scientist' archetype (*Ambix* 53, 99–127; 2006). The much older image of the avaricious and swindling alchemist had come by then to represent the striving for material goods, and often the attendant atheistic materialism, that was condemned by Romantic writers. So it is perhaps not surprising that diamond, like gold a precious natural material, became another symbol of the chemist's bad intent.

The first literary caricature of this kind is the Faustian hero of *Der Komet oder Nikolaus Marggraf* (1820–1822) by the German writer Jean Paul. *The Diamond Maker* (1894) by H. G. Wells is, as one might expect, less wary of science in general but presents an amateur chemist whose obsession with creating diamond leads to only to poverty in the manner of the medieval mad alchemist.

Balzac's hubristic chemist in *La Recherche de L'Absolu* (1834) also exclaims to his wife that 'I shall make diamonds, I shall be a co-worker with Nature!'— whereupon she scolds him for his pride. These writers often drew on contemporary chemistry to justify the plausibility of their tales — Lavoisier and Smithson Tennant had shown at the end of the eighteenth century that diamond was nothing but pure carbon. By the 1850s, there were several claims that it had been synthesized (Wells mentions that of Henri Moissan in the 1890s).

In due course diamond-making was seen as a regular capitalist pursuit. Karl Marx used it to show how rare materials become fetish objects, divorced from any true measure of value. If with minimal labour we could convert carbon to diamond, he said, 'their value might fall below that of bricks.' Olaf Nissen's 1940s Allied propaganda pamphlet *Germany: Land of Substitutes*, accuses the Nazis of producing all manner of fake materials, including gems.

These tales leave their traces in broader culture. They would certainly help to explain why one critic of the GE high-pressure process, announced in 1955, objected that 'You can't make diamonds for they are nature grown.'

Philip Ball