Graphene's piezoelectric promise

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Engineers predict that graphene can be coaxed into acting piezoelectric, merely by punching triangular holes into the material.

Graphene, the ultra-durable carbon material that holds promise for a range of applications, has yet another trick up its single-atom-thick sleeve.

Engineers at the University of Houston have used quantum mechanical calculations to show that, merely by creating holes of a certain configuration in a sheet of graphene, they can coax graphene into behaving like a piezoelectric material. Piezoelectric substances generate electricity in response to physical pressure, and vice versa, and scientists can use these materials for applications such as energy harvesting and artificial muscles, as well as to make precise sensors.

Graphene itself is not naturally piezoelectric. But the Houston engineers reasoned that if they took either a semiconducting or insulator form of graphene, punched triangle-shaped holes into it, and applied a uniform pressure to the material, they could make that material act as though it were piezoelectric.

The team's calculations showed that triangular holes did indeed result in piezoelectric behavior, while circular holes – as they predicted – did not. They also found that graphene's pseudo-piezoelectricity was almost as strong as that of well-known piezoelectric substances such as quartz. The authors suggest that triangular pores could be created in real graphene using electron-beam radiation in a lab, which means these calculations can be tested using existing methods.

"Nature has dealt humankind … a very limited choice of effective electromechanical materials" that exhibit piezoelectricity, write the authors in their paper, accepted to the AIP's *Applied Physics Letters*. Adding graphene to the list "could potentially open new avenues" of use, both for graphene and for applications that rely on piezoelectricity.

More information: "Coaxing graphene to be piezoelectric" is accepted for publication in *Applied Physics Letters.*

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