Writing graphene circuitry with ion 'pens'

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The unique electrical properties of graphene have enticed researchers to envision a future of fast integrated circuits made with the one-carbon-atom-thick sheets, but many challenges remain on the path to commercialization. Scientists from the University of Florida have recently tackled one of these challenges – how to reliably manufacture graphene on a large scale.

The team has developed a promising new technique for creating graphene patterns on top of silicon carbide (SiC). SiC comprises both silicon and carbon, but at high temperatures (around 1300 degrees Celcius) silicon atoms will vaporize off the surface, leaving the carbon atoms to grow into sheets of pure graphene. Researchers had previously used this thermal decomposition technique to create large sheets of graphene, which were then etched to make the patterns required for devices. The etching process, however, can introduce defects or chemical contaminants that reduce graphene's prized electron mobility.

In contrast, the Florida team's technique allowed the researchers to confine the growth of graphene to a defined pattern as small as 20 nanometers. The team found that implanting silicon or gold ions in SiC lowered the temperature at which graphene formed by approximately 100 degrees Celcius. The team implanted ions only where graphene layers were desired, and then heated the SiC to 1200 degrees Celcius. At this temperature the pure SiC did not form graphene, but the implanted areas did. Using this technique, the team successfully created graphene nanoribbons, thin lines of graphene with nanoscale dimensions.

With further refining, the process, described in the American Institute of Physics' journal *Applied Physics Letters*, may be able to encourage selective graphene growth at even lower temperatures, the researchers write.

More information: "Drawing graphene nanoribbons on SiC by ion implantation" is published in *Applied Physics Letters.*

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