

Applying diamond coatings at lower temperatures expands options for electronic devices

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A new method for creating thin films of diamonds, which is described in the journal *Applied Physics Letters*, produced by AIP Publishing, may allow manufacturers to enhance future electronics.

In industrial and high-tech settings, diamonds are particularly valued for their hardness, optical clarity, smoothness, and resistance to chemicals, radiation and [electrical fields](#). For [electronics applications](#), researchers "dope" diamonds in order to make them conductive, introducing the semiconductor boron into the diamond manufacturing process. In the past, it has been a challenge to imbue electronic devices with diamond-like qualities by applying a doped diamond coating, or thin film because the [high temperatures](#) required to apply a doped diamond thin film would destroy sensitive electronics, including biosensors, semiconductors, and photonic and optical devices.

In their *Applied Physics Letters* paper, a team of researchers at Advanced Diamond Technologies, Inc., in Romeoville, Illinois report creating thin films of boron-doped diamond at temperatures low enough (between 460-600°C) to coat many of these devices.

While low-temperature deposition of boron-doped diamond thin films is not conceptually new, the research team found no evidence in the literature of such diamond films that had both sufficient quality and manufacturing rates fast enough to be commercially useful. Tweaking

their own normal-temperature boron doping recipe by both lowering the temperature and adjusting the typical ratio of methane to [hydrogen gas](#) yielded a high quality film without appreciable change in conductivity or smoothness compared to diamond films made at higher temperatures. The researchers say more data and study is needed to better understand low-temperature opportunities.

Even so, by further optimizing the recipe, the researchers expect to be able to deposit boron-doped diamond thin films at temperatures even lower than 400° C.

"The lower the deposition temperature, the larger number of electronic device applications we can enable," said Hongjun Zeng of Advanced Diamond Technologies, Inc. "That will further expand the product categories for thin, smooth, conductive diamond coatings," Zeng added.

More information: The article, "Low Temperature Boron Doped Diamond" by Hongjun Zeng, Prabhu U. Arumugam, Shabnam Siddiqui, and John A. Carlisle appears in the journal *Applied Physics Letters*. [dx.doi.org/10.1063/1.4809671](https://doi.org/10.1063/1.4809671)

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