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## Biocompatible and second only to diamond in hardness

Cubic boron nitride shown to be promising as an ultrahard coating for bio-applications

An international team of researchers has reported for the first time the biocompatibility of the second hardest known material, opening the possibility for a new ultrahard coating material for biological and biomedical applications.

Second only to diamond in hardness, cubic boron nitride (*c*-BN) has a crystalline structure similar to that of the precious stone but with boron and nitrogen atoms instead of carbon. But any slight disadvantage *c*-BN may have in terms of hardness it makes up for with superior stability, not reacting to oxygen and ferrous materials even at high temperatures up to around 1,000 °C, unlike diamond.

However, synthesis of high-quality *c*-BN has been difficult until recently, so applications for *c*-BN are more than twenty years behind diamond. Furthermore, most attention has been put on mechanical and electronic applications such as for cutting tools and semiconductors.

New research from Kyushu University, the National Institute for Materials Science, and Stony Brook University (USA) now shows that *c*-BN is also promising for harsh biological environments in contact with living organisms and blood.

Preparing high-quality *c*-BN films with a plasma chemical vapor deposition technique that they developed, the research team found they could enhance the film's surface wettability—basically how well water, and cells, can adhere to it—using a plasma treatment technique that includes bombarding the surface with low-energy ions.

The team demonstrated successfully the growth of a large number of cells and the formation of mineral deposits—indicative of biomineralisation—on the superhydrophilic *c*-BN films prepared in this way.

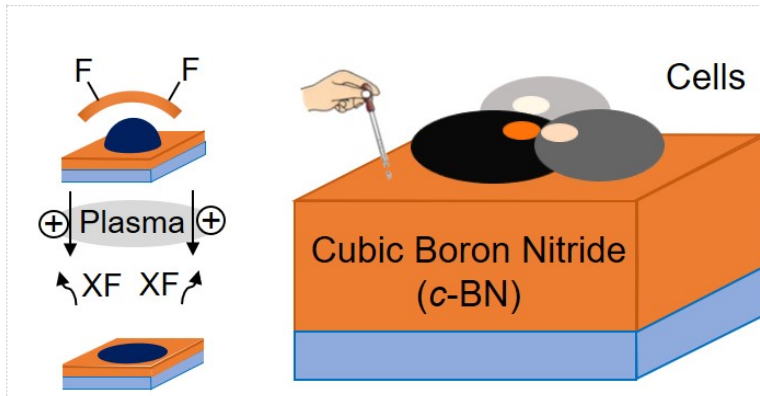
These results confirm the high potential of *c*-BN as a noncytotoxic, ultrahard coating material for biological and biomedical applications such as artificial bones, dental implants, and biosensors.

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For more information about this research, see “Biocompatible cubic boron nitride: A noncytotoxic ultrahard material,” Jason H. C. Yang, Kungen Teii, Chung-Chueh Chang, Seiichiro Matsumoto, and Miriam Rafailovich, *Advanced Functional Materials* (2020). <https://doi.org/10.1002/adfm.202005066>

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Researchers" from Cabinet Office, Government of Japan (PI: Kungen Teii).



Schematics of plasma modification of a c-BN film for enhancing wettability and biological test on a c-BN film.

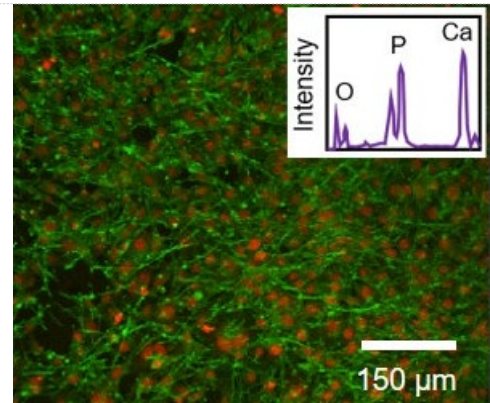


Image of cells cultured on a c-BN film and typical energy dispersive X-ray spectroscopy spectrum.

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