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Now, warm ice coating to make medical implants biocompatible

From our ANI Correspondent

Washington, Sept 5: Layers of ice only a few nanometres thick can remain frozen at human body temperature, when grown on top of diamond sheets coated with a surface layer of sodium, a recent study by a Harvard University research team has revealed.

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Thin diamond coatings are used in a growing number of wear-resistant medical implants, such as prosthetics, artificial heart valves and joint replacements.

However, diamond can cause clotting by attracting coagulating proteins. Also, its hardness often results in more tissue abrasion than with other implant materials.

Ice, on the other hand, could help make diamond-toughened medical implants more biocompatible by offering an interface of water molecules.

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During the course of their study, Alexander Wissner-Gross and Efthimios Kaxiras calculated that bonding a layer of sodium atoms to the diamond surface would sustain a layer of ice around two nanometres thick at 37 Degree C (human body temperature), thus providing a biologically compatible "barrier" to the diamond itself.

The researchers arrived at their result by using a computer simulation based on "molecular dynamics".

In particular, they simulated the motion of water atoms sitting on top of a sodium-diamond surface at different temperatures over long time periods.

The calculations showed that the ice layer could remain frozen at elevated temperatures due to dipole interactions between the water molecules and the film surface.

Earlier, in 2001, researchers had produced tiny tubes of ice inside carbon nanotubes, and last year another group had created nanoscale ice at room temperature, and showed that this could act like unwanted "glue" in extremely small devices of the future. But, this is the first time scientists have suggested a practical application for nano-ice.

"We think our discovery will prove crucial for making scratch-resistant diamond coatings for medical implants - such as prosthetic joints - more bio-friendly," said Wissner-Gross.

"The warm ice layer stabilised by the diamond could protect tissue from abrasion, as well as prevent blood clotting on the diamond's surface," New Scientist quoted him as saying.

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David Martin, a professor of biomedical engineering at the University of Michigan and chief scientific officer at Biotectix, a company that makes soft, polymer coatings for biomedical devices, said though this was an interesting development, it might not still solve the main problem with such devices - that the mechanical properties of implants are incompatible with those of soft, biological tissue.

"The ice coating will be extremely thin and flat, and the difference in mechanics, as seen by a cell, will not be much different than the uncoated object," he said.

Wissner-Gross has produced a short film about the research, which can be viewed on his website.

The research appears in the journal Physical Review E.

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