Scientists measure electrical conductivity of pure interfacial water

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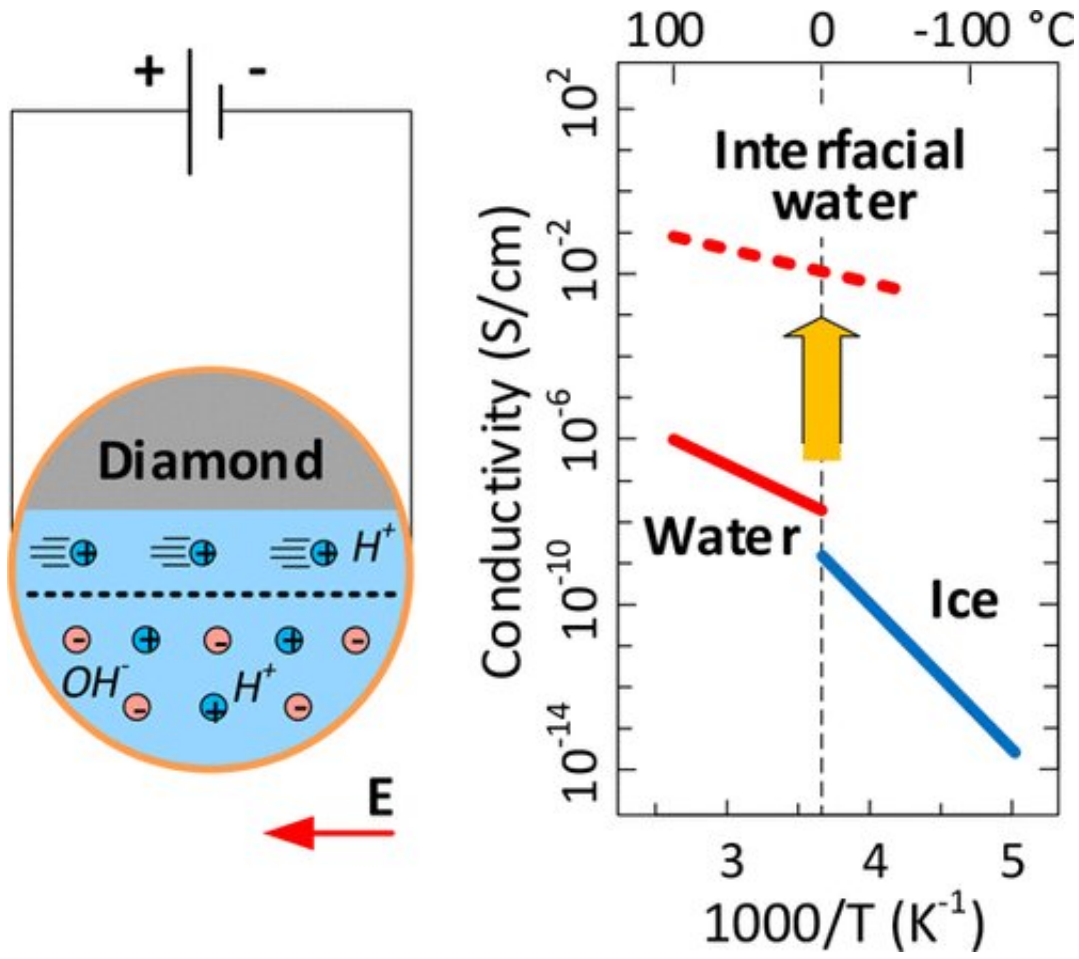

Graphical abstract. Credit: *Journal of Physical Chemistry Letters*

Skoltech scientists in collaboration with researchers from the University of Stuttgart, the Karlsruhe Institute of Technology and the Russian

Quantum Center have achieved the first systematic experimental measurements of the electrical conductivity of pure interfacial water, producing new results that significantly expand the knowledge of interfacial water.

Interfacial water may be found everywhere around us. Biological systems, electrochemical devices, food preservation methods and climate-related processes, among others, all depend on the properties of water near interfaces. However, direct access to the physical-chemical properties of pure interfacial water is arduous and explains why much remains to be discovered and understood.

The results obtained by the scientists from the Skoltech Center for Energy Science and Technology (CEST) in collaboration with German researchers provide new and detailed insights into complex fluids. The discovery of new electrical properties of interfacial water will clearly have impact on the future development of electrochemical systems, both for electrical power generation and storage.

"We used diamond-based ceramics with an open-pore structure filled with water. By consistent reduction of the pore size from 500 nm to 5 nm, we increased the interfacial-to-bulk-water ratio up to its maximum, at which point the interfacial water showed anomalous DC conductivity, five orders of magnitude higher than that of the bulk water. Our analysis shows that this unusual conductivity is a genuine intrinsic property of the interfacial water, as the surface chemistry contribution clearly appears not to be the dominant one," says Vasily Artemov, senior research scientist in the group of Skoltech professor Henni Ouerdane.

"The topic of interfacial water is of immense interest to a wide audience of physicists, electrochemists, climate researchers, geologists and biologists, and we anticipate that the research we report will be influential across a diverse range of scientific and technological fields,

such as electrochemical energy systems, membrane technologies and nanofluidics," said Henni Ouerdane.

More information: V. G. Artemov et al, Anomalously High Proton Conduction of Interfacial Water, *The Journal of Physical Chemistry Letters* (2020). DOI: 10.1021/acs.jpclett.0c00910

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