Scilight

23 September 2020

Graphene turns water current into electrical current

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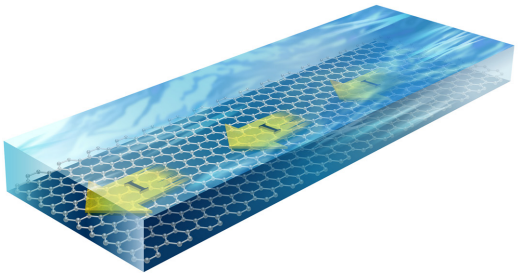
Water flowing over carbon-based materials can generate electrical energy, but a better understanding and quantification of this process is needed for practical applications.



Energy can be harvested by water flowing over graphene or other carbon-based materials. However, the mechanism governing this process is unknown, making it difficult to apply as a viable form of electricity generation. Kuriya et al. quantified the energy output of this method and studied its dependence on various parameters.

The authors determined the impacts of water flow speed and the contact area between the graphene and the fluid. They found the generated voltage and electromotive force increase with these parameters, with the generated current oriented in the direction of water flow. Notably, the process is repeatable, reproducible and agrees well with equivalent circuit calculations.

To enable this process to occur, the group transferred graphene onto a glass substrate and guided water along its top. They optimized the external load resistance applied to the graphene to maximize the output power under different flow speeds.

Though the maximum performance is small, the authors note the ability to quantify it is a crucial step toward future electricity generation applications.

“Improvement of output power is an important issue for practical use,” said author Takeru Okada. “The total amount of output power is small at present but not all devices need continuous operation. We can also combine a secondary battery with the flow-induced electricity system.”

Further studies are still needed to explain how this process generates electricity in the first place. The next step to answering this question is comparing the effects of water flowing in different directions.

Source: “Output density quantification of electricity generation by flowing deionized water on graphene,” by Kei Kuriya, Kotaro Ochiai, Golap Kalita, Masaki Tanemura, Atsuki Komiya, Gota Kikugawa, Taku Ohara, Ichiro Yamashita, Fumio S. Ohuchi, M. Meyyappan, Seiji Samukawa, Katsuyoshi Washio, and Takeru Okada, *Applied Physics Letters* (2020). The article can be accessed at https://doi.org/10.1063/5.0018862.