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Pulsed mechanical device generates plasma in water via cavitation

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Plasmas are conventionally generated by manipulating electric and magnetic fields[1]. A bio-inspired mechanical device mimicking snapping shrimp snapper claw based on micro X-ray computed tomography (μ -CT) scanning was designed to explore the possibility of producing plasma mechanically[2]. The major parts of the bio-inspired device including dactyl plunger and a matching socket with sophisticated 3D geometry were manufactured using additive manufacturing technique to produce a pulse of high speed water jet for inducing cavitation. High-frame-rate charge-coupled device (CCD) camera was applied to capture the cavitation generation of the device in water, and an intensified charge-coupled device (ICCD) camera was utilized to capture the light emission signals. Light emission evidence was verified in distilled water with air doping and argon doping respectively. The comparison of electrical generated cavitation and mechanically generated cavitation were presented. Organic compounds like isopropyl alcohol and mineral oil were also used as working fluids for the bioinspired device compared to water. The bio-inspired device has an insightful potential to be implemented as a pulsed plasma source and an efficient cavitation source. Therefore, this design can be applied to enhance microfluidics, chemical processing, physical processing and hydroacoustics.

1. Samukawa, Seiji, et al. "The 2012 plasma roadmap." *Journal of Physics D: Applied Physics*, 2012, 45(25), pp. 253001.
2. Xin Tang, David Staack. "Bioinspired mechanical device generates plasma in water via cavitation." *Science Advances*, 5, eaau7765 (2019).

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