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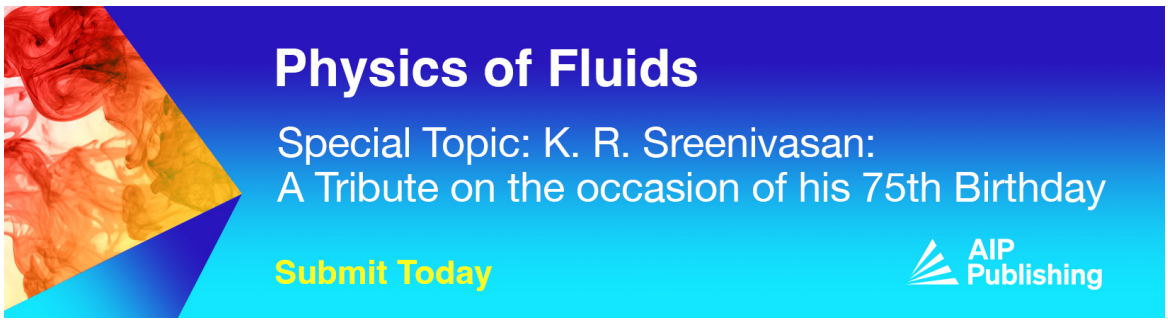

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Statistical analysis sparks new knowledge on electrical discharge in liquids

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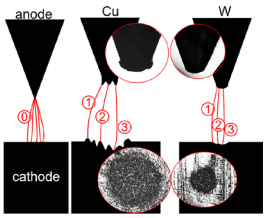
Examining how voltage polarity, interelectrode gap distance, and electrode nature impact the stochastic discharge process



Electrical discharge in liquid can create instantaneous and often inaccessible plasmas at high temperatures and pressures. These unique conditions are used to synthesize novel nanoparticles and process liquids for applications like water depollution and fuel reforming.

However, discharges in liquid are stochastic in nature, so applying the exact same experimental conditions will likely not result in a similar discharge. In a sequence of discharges, the initial events will modify the electrode conditions, via erosion, and the liquid, via dissociation of molecules. Applications of the technique often involve a high number of discharges in a row, so understanding how the system evolves throughout the process is essential.

To this end, Dorval et al. statistically examined the electrical characteristics of multiple discharges run in deionized water.

Their experiment consisted of metal electrodes immersed in liquid. They acquired electrical measurements and analyzed them to investigate the main characteristics of the discharge with different voltage polarities, interelectrode gap distances, and the electrode natures.

“The discharge characteristics evolve strongly with the number of occurred discharges, mainly due to electrode erosion and modification of the solution properties,” said author Ahmad Hamdan. “We demonstrated that discharges stop after a certain number.”

Under specific configurations, the team observed a reflected voltage pulse that had an inverse polarity and lower amplitude compared to the primary pulse but could also instigate discharge.

“This work is among the first to address the statistical evolution of the discharges. Often, one uses the average value, and we rarely look at single discharges,” said Hamdan. “But as each discharge modifies the experimental conditions, we believe it is crucial to address their individual characteristics.”

Source: “Statistical analysis of pulsed spark discharges in water: Effects of gap distance, electrode material, and voltage polarity on discharge characteristics,” by Audren Dorval, Korentin Geraud, Flavien Valensi, and Ahmad Hamdan, *Journal of Vacuum Science & Technology A* (2022). The article can be accessed at https://doi.org/10.1116/6.0001923.

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