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Microdischarges: novel designs and novel materials¹

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Following an initial surge in microdischarge applications, research in this area has followed two main approaches, with one approach focused on expanding the range of applications for both new and existing devices and the other approach concentrating on understanding the basic physics underlying device operation in these small-volume, high-pressure discharge devices. Despite the application of increasingly sophisticated diagnostic methods, there are still many areas where understanding is, at best, limited. The research reported here centres on understanding the importance of the materials used to fabricate microplasma devices, focusing on the operational behaviour of microhollow cathode discharges. We operate a range of devices that include discharges constructed from simple metal-insulator-metal sandwich structures, Si-SiO₂-metal devices fabricated on silicon wafers and, most interestingly, diamond-diamond-metal devices fabricated using a combination of diamond CVD deposition and microlithography. We report on the effect of materials on device ignition, breakdown voltage, and IV characteristics, and we make tentative conclusions about device lifetimes. We will also report on new work involving novel geometries for microhollow cathode discharges, including multi-electrode devices.

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