Development of microdicharges in silicon operating in DC for medical applications

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Potential applications of microdischarges are numerous and include local treatments, lab on chip, sterilization… One of the most important technological and scientific issues of these new microdevices remains the elaboration of the microreactors. They have to be robust enough to sustain power densities as high as few hundreds of kilowatts per cubic centimeter.
Arrays of microreactors built from silicon wafers in clean room facilities have been proposed and developed recently [1]. They consist of Micro Hollow Cathode Discharges (MHCD) operating in parallel in DC. One of the remarkable properties of these MHCDs relies on the fact that they can operate in DC, in a stable regime at atmospheric pressure, without evolving to an arc regime [2]. Operation in AC is also possible and offers some advantages in terms of homogeneity and life time [3,4].
We will present recent results obtained in DC excitation. Discharges were performed in helium and Argon. The microreactor geometry was investigated to achieve the best results in terms of life time and ignition. Although we were able to ignite up to 1024 microdischarges (100 µm diameter holes) (figure 1), we observed many spikes on the current waveform, which indicate that the microplasma is not so stable. We varied different parameters such as pressure and current. V-I curves were systematically acquired during the experiments. Optical characterizations were also carried out (imaging system and optical emission spectroscopy). Breakdown mechanisms in DC were investigated [5]. The life time of the device varies from few minutes to few hours in DC operation depending on the injected power. We have studied the damage mechanisms of our microdevices by using a Scanning Electron Microscope.

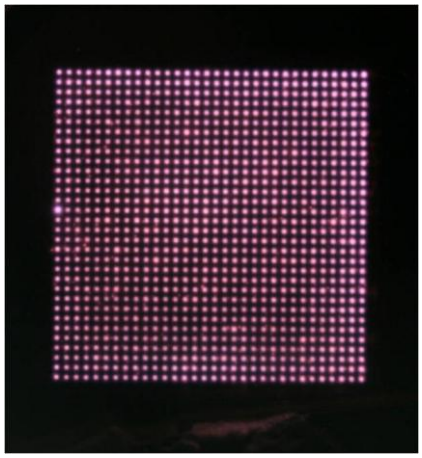

Figure 1 : Array of 1024 MHCDs of 100 µm diameter operating in Helium at 350 Torr

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