BREAKDOWN PHENOMENA IN CERAMIC HONEYC OMB MONOLITHS

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Atmospheric pressure discharges have been developed for various plasma chemical and electrostatic processes, for example particle and dust removal, exhaust odour control, surface modification and biomedical fabrication.

Recently there has been increased interest in atmospheric plasma processes in organized or random two-phase media such as conducting and insulating porous solids, foams and monoliths. It has been shown that efficiency and selectivity of plasma chemical processes may be improved if combined with a catalyst[1]. The generation of reactive plasmas inside porous media is also attractive from the point of view of the filtration industry, where cordierite honeycomb monoliths are used, sometimes in combination with catalysts, for gas and particulate emission reduction to meet the increasingly stringent pollution control standards. The phenomena governing the plasma electrical energy deposition in honeycomb structures are of particular interest as the creation of a uniform, stable and effective plasma in the narrow channels of the honeycomb presents a considerable challenge[2].

In the present study, unipolar high voltage pulses of <10 μs duration and ~ 10 Hz frequency were applied to soot collected in a filter. The soot was present in the pores of the ceramic filter walls and as a thin layer on the channel surfaces and in contact with a ground electrode.

On application of the voltage, a multitude of randomly occurring and fast moving 'microsparks' and plasma filaments could be observed which led to a weak erosion of the soot layer. The particulate layer is thought to act like a number of small capacitive spark gaps separated by resistance. Breakdown within the layer enables conducting current flow to ground. Results from optical observation and time resolved current and voltage measurements were used to assist the interpretation of the processes.

1. C. Ayrault et al., "Oxidation of 2-heptanone in air by a DBD-type plasma generated within a honeycomb monolith supported Pt-based catalyst", Catalysis Today, Vol. 89, 2004, pp. 75-81
2. K. Hensel et al., "Microdischarges in ceramic foams and honeycombs", Eur. Phys. J. D, Vol. 54, 2009, pp. 141-148