DPF Regeneration Using MW

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Abstract

Diesel Particulate Filter (DPF) is a well-established technique in soot capturing from diesel engines, in particularly, in cars, vans and trucks. DPF requires regular regeneration to remove the captured soot and it is generally achieved passively by exhaust gas with increased temperature. Microwave energy for regeneration is a promising technology [1] for number reasons as listed below:
(1) Rapid heating
(2) Instantaneous penetration of microwave into dielectric materials and
(3) Lower soot combustion temperature

In this paper, a microwave heating scheme of DPF regeneration is proposed and COMSOL Multiphysics® FEM model was used to investigate microwave heating properties of the Silicon Carbide (SiC) based DPF. Electric field profile and thermal profile of the microwave cavity and DPF was investigated in order to achieve an efficient heating of DPF. Figure 1 and Figure 2 shows the computed electric field distribution within a microwave cavity available in the CESR, Brunel University. These electric field calculations were obtained from the simulations of COMSOL Multiphysics FEM model when microwave power is 1kW (2 x 500W). Figure 3 shows an experimental results; DPF before regeneration (with 20 g of soot) and after regeneration using the same microwave cavity. The major aim of modelling work is to find an optimum microwaved cavity so that homogeneous electric field distribution (hence homogeneous heating) can be achieved.

Reference

(1) Palma et. al, 'Catalytic DPF microwave assisted active regeneration', Fuel 140 (2015) 50–61.

Figures used in the abstract

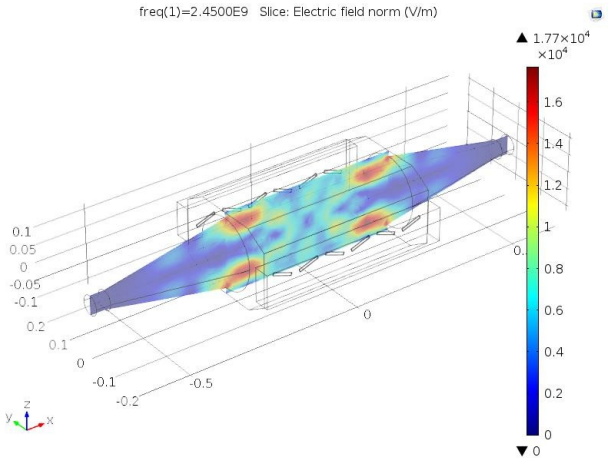

Figure 1: Electric Field distribution:ZX plane.

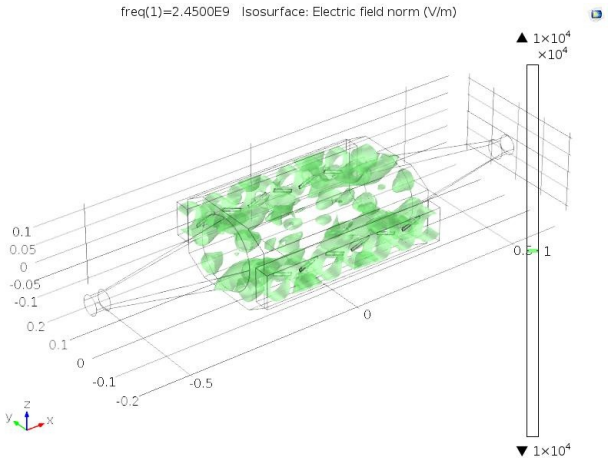

Figure 2: Electric Field Distribution: Isosurface plot.