Modelling support for high performance modelling of Particulate filters

1. Background

The environmental and health problems associated with local emissions from vehicle transportation is becoming more evident and thus more urgent to resolve than ever. The evidence and body of knowledge of health effects from emissions of Particulate Matter (PM) is growing and even local authorities (in larger cities) are now ahead of the European legislators (e.g. banning of vehicles using ICEs).

Modelling of filters and soot oxidation is a difficult task and there are many "no-return alleys" which will need to be revised for improved modelling of filters. These issues include

1. Global kinetics approach
2. Mean field approximation
3. Single-channel approximation

2. Project description

This project aims at developing a modelling framework of particulate filters using a commercial software. The objective is to obtain a model that can handle

- a complex inlet flow (exhaust gas flow with particles of different size and composition),
- a particle trapping mechanism including (local) particle size distribution and (local) filter properties (prevailing soot cake, filter wall porosity etc)
- a soot oxidation mechanism (simple, global reaction scheme at first stage)
- transient operation (in flow, temperature and in particle inlet conditions)

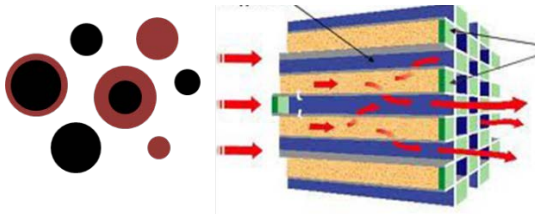

Figure 1 A schematic view of the PM emissions that has a variation in size and chemical composition. In the filter both filtration and chemical reactions needs to be handled

3. Outlook

The project will collaborate with other on-going projects at CERC including:

- PM deposition experiments
- PM oxidation experiments
- Engine rig experiments using advanced combustion and renewable fuels

By working with modelling and experiments in an iterative way, increased understanding of the PM removal is foreseen.