Contribution to the modelling of regeneration process in wall-flow DPFs

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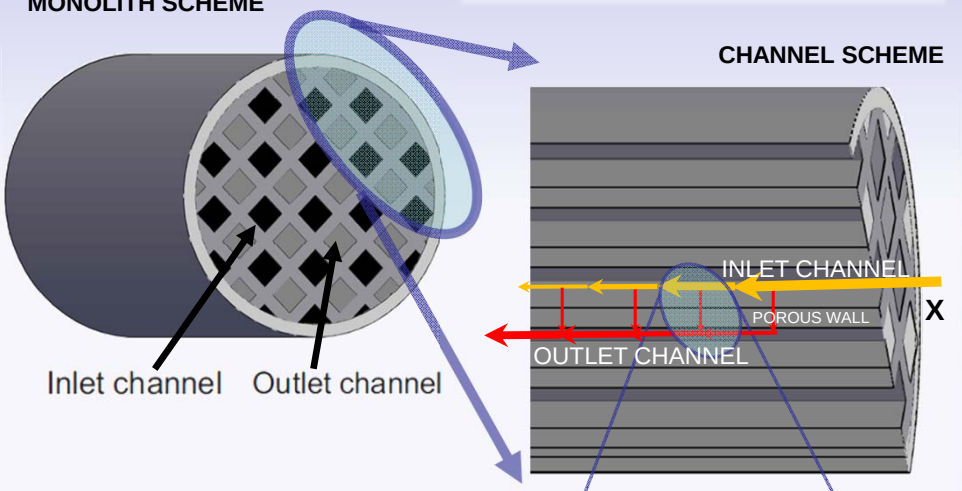
OBJETIVES

Develop a regeneration model to predict the rate of oxidation of soot in the particulate filter that considers:

- **Control volume definition.**
- **Chemical kinetics.**
- **Mass and heat balance.**

CONTROL VOLUME



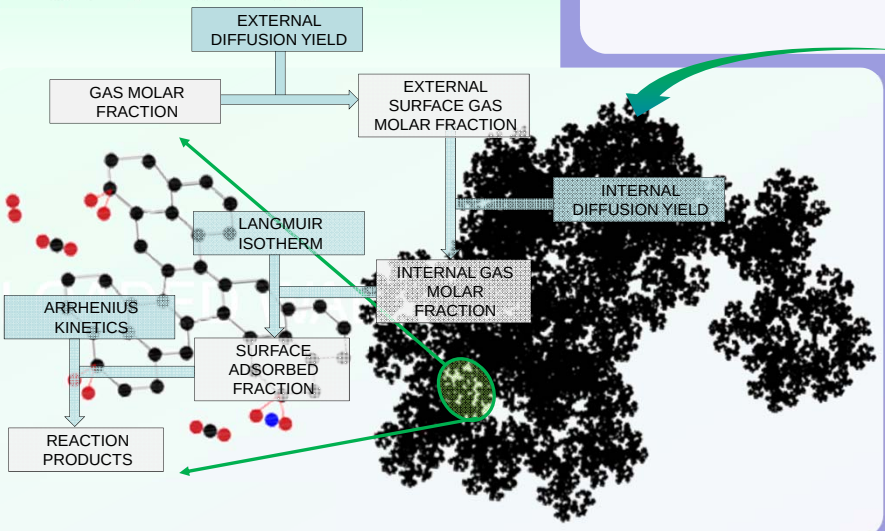
CHEMICAL KINETICS

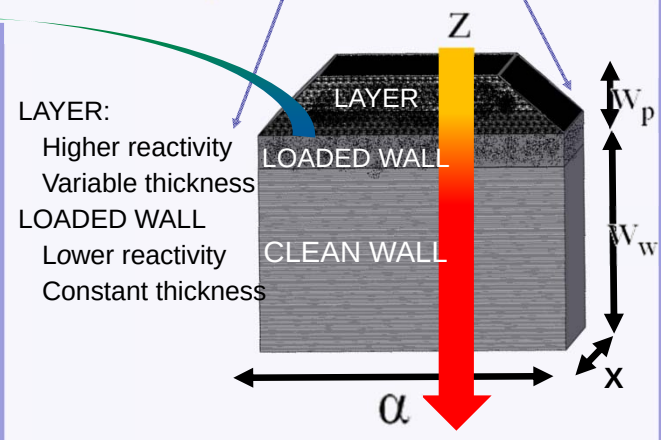
PASIVE REGENERATION:

$$C + \alpha_{NO_2} NO_2 \rightarrow \alpha_{NO_2} NO + (2 - \alpha_{NO_2}) CO + (\alpha_{NO_2} - 1) CO_2$$

ACTIVE REGENERATION:

$$C + \alpha_{O_2} O_2 \rightarrow 2(1 - \alpha_{O_2}) CO + 2(\alpha_{O_2} - 0.5) CO_2$$



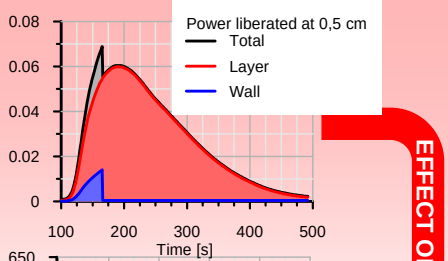


MASS AND HEAT BALANCE

HEAT

$$\dot{q}_{Reg} = \dot{q}_{Reg,O2} + \dot{q}_{Reg,NO2}$$

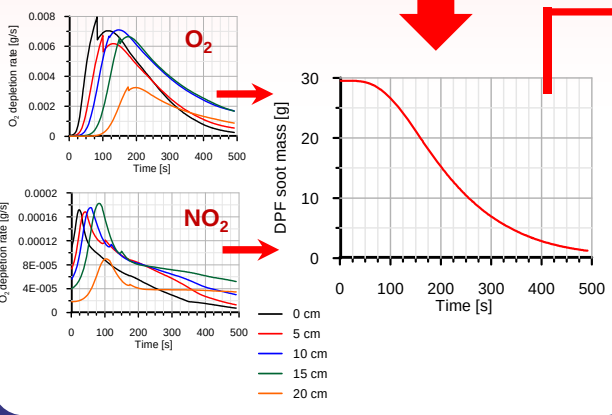
POWER GENERATED IN LAYER
POWER GENERATED IN LOADED WALL
→ TOTAL POWER GENERATED

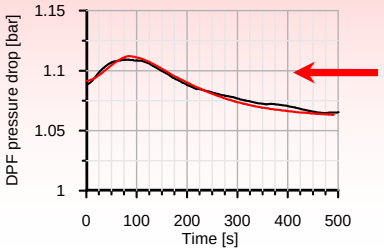


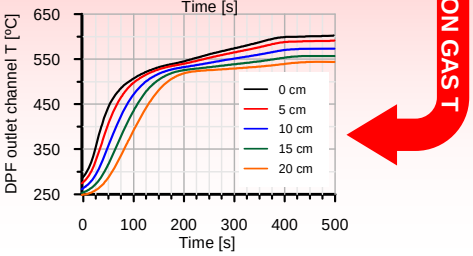
EFFECT ON GAS T

MASS

$$m_{C,Reg} = PM_C \Delta t \left(\frac{1}{\alpha_{NO2}} \frac{\partial n_{NO2}}{\partial t} + \frac{1}{\alpha_{O2}} \frac{\partial n_{O2}}{\partial t} \right)$$







CONCLUSIONS AND FUTURE WORKS

The model has demonstrate its capability to predict properly the soot mass regenerated and the heat liberated during this process. The detailed chemical mechanism gives a great range of application to the model.

The model is going to be used in estimation of effect of the soot distribution along the channel in regeneration with special attention to the appearance of hot spots. Also this model will be used in simulations of the NEDC cycle.