
Contribution ID: **457** Type: **Oral Presentation**

# Homogenization approach to the upscaling of a reactive flow through particulate filters with wall integrated catalyst

*Thursday, 3 June 2021 11:15 (15 minutes)*

Catalytic membranes can degrade gaseous pollutants to clean gas via a catalytic reaction to achieve green emissions. A catalytic membrane is a three scale porous medium. Membranes used in catalytic filters usually have thickness centimeters or millimeters, and consist of active (washcoat) particles, inert material and microscale, micron size, pores. The washcoat particles are porous material with nanoscale pores. The catalytic reactions are heterogeneous (surface reactions)
and they occur on the surface of the nanopores. Obviously, simulations at fully resolved pore scale are not feasible, and upscaling techniques have to be applied. It is known that the same microscale problem can be upscaled to different macroscale equations depending on the characteristic
numbers. In this paper we study the homogenization of reactive flow in the presence of strong absorption in the washcoat particles. Two reactive transport regimes are studied, in both the reaction dominates over the convection and the diffusion. Peclet's number in the first one is of order 1, and in the second one it is proportional to the ratio of the thickness of the catalytic membrane and the characteristic length of the microscale pores. Two different upscaled equations are obtained, respectively. Direct numerical simulation at microscale is used to validate these derived macroscale equations.

## Time Block Preference

Time Block B (14:00-17:00 CET)

## References

## Acceptance of Terms and Conditions

Click here to agree

## Newsletter

## Student Poster Award

**Primary authors:** ILIEV, Oleg; Prof. MIKELIC, Andro; Dr PRILL, Torben (German Aerospace Center (DLR))

**Presenter:** ILIEV, Oleg

**Session Classification:** MS24

**Track Classification:** (MS24 - Invitation Only) Mathematical and computational challenges related to porous media - Special session in memory of Andro Mikelic