## Supplementary information for: “Infrared thermography as an operando tool for the analysis of catalytic processes: how to use it?”

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**Modelling of the reaction cell**

The reaction cell is modeled by solving the mass and heat balances in a 1D pseudo-homogenous reactor model:

 (1)

 (2)

The catalyst efficiency factor is calculated via the Thiele modulus:

 (3)

 (4)

The heat transfer coefficient considers both the calculated by the contribution of convective and radiative heat transfer.

Convective heat transfer:

 (5)

 Is calculated considering a stagnant and a dynamic contribution:

 (6) The radiative heat transfer is calculated by linearization of the black body radiation equation, linearized in the temperature interval considered:

 (7)

The reaction rate is calculated according to the model by Falbo et al. [1] for the 0.5% Ru/Al2O3 catalyst, while the reaction rate for the 2% Ru/Al2O3 catalyst is obtained by interpolation of the values proposed by Wang et al. [2]

**List of symbols**

 = gas velocity (m/s)

= concentration of the species

= stoichiometric coefficient of the species

 = catalyst efficiency

= density of the bulk (kg/m3)

= reaction rate (mol/s/m3)

 = total concentration (mol/m3)

 = Temperature (K)

 = reaction enthalpy (J/mol)

 = diameter of the tube (m)

 = total heat transfer coefficient (W/m2/K)

 = convective heat transfer coefficient (W/m2/K)

 = radiative heat transfer coefficient (W/m2/K)

 = temperature of the coolant (K)

 = Thiele modulus

 = volume of the particle (m3)

 = surface of the particle (m2)

 = reaction order

 = diffusion coefficient (m2/s)

 = local heat transfer coefficient (W/m2/K)

 = characteristic length (m)

 = Reynolds number

 = emissivity

 = Stefan-Boltzmann constant (W/m2/K4)

**References**

1. Falbo, L.; Martinelli, M.; Visconti, C.G.; Lietti, L.; Bassano, C.; Deiana, P. *Appl. Catal. B Environ.* **2018**, *225*, 354–363, doi:10.1016/j.apcatb.2017.11.066.

2. Wang, X.; Hong, Y.; Shi, H.; Szanyi, J. *J. Catal.* **2016**, *343*, 185–195, doi:10.1016/j.jcat.2016.02.001.