Mini-symposium MS18

(MS18) High-temperature heat and mass transfer within porous materials for energy and space

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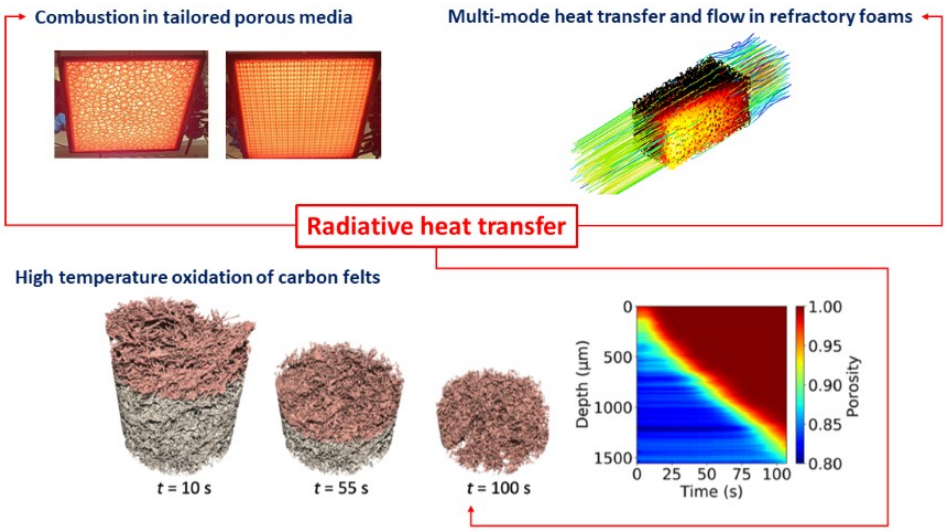
Lead Organizer: Benoît Rousseau - University of Nantes, France



- Sophia Haussener - EPFL, Switzerland
- Francesco Panerai - University of Illinois Urbana-Champaign, USA
- Jaona Randrianalisoa- Université de Reims, France
- Dimosthenis Trimis - KIT, Germany

Refractory cellular materials (carbon felts, open-pored ceramic foams, structured ceramics, etc.) are at the heart of strategic development in key industrial sectors, whether for carbon-free energy production or reusable spacecraft. Their high specific surface area, high strength-to-weight ratio, good flow-mixing capacity, high thermal shock resistance, and high resistance to chemical corrosion enable the design of lightweight, compact, high-temperature heat conversion, transport, and storage systems. In order to optimise their overall performance, it is necessary to have a precise understanding of the spatial distribution of heat within their volume, which requires taking into account all modes of heat transport, including radiative transfers. In terms of radiation, cellular refractory materials are semi-transparent media in which the interaction between thermal radiation and matter is reflected by light scattering, absorption and emission. Mathematically, these physical phenomena are described by the integro-differential equation of radiative transfer. If, in addition, fluids, which are themselves semi-transparent, penetrate the cellular support materials, the problem becomes even more complex given the coupling and non-linearity. Modelling the transport of fluids (gas, plasma) through these materials, which may themselves be semi-transparent, adds an extra degree of complexity. This mini-symposium will provide an opportunity to review the experimental and numerical approaches that are currently the focus of attention: topological optimisation, whether AI-driven or not, performance of architectures obtained through additive manufacturing, management of thermal couplings at local or continuous scale, numerical methods for solving transport equations, and development of experimental set-up for characterising high-temperature effective thermophysical quantities and depicting the 3D architectures.

Solicited Speakers:

- Gérard Vignoles - University of Bordeaux, France
Random-Walk simulation methods for the modeling of ballistic/diffusive heat and mass transfer in evolving porous media
- Antonio Avila-Marin - CIEMAT, Spain
Experimental Investigation of Periodic Porous Ceramic Solar Absorbers for Volumetric Receiver Applications
- Bruno Dias - AMA at NASA Ames Research Center (ARC), USA
One-domain approach for simulating ablative porous materials in high- enthalpy flows