POLITECNICO DI TORINO

multiScale ModeLing Laboratory

Master thesis proposals @ SMaLL

(DENERG Department)

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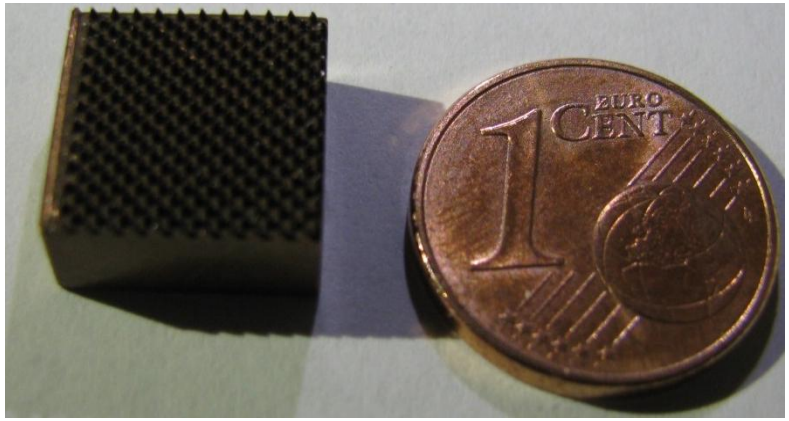
Innovative surface coatings for high heat transfer efficiency

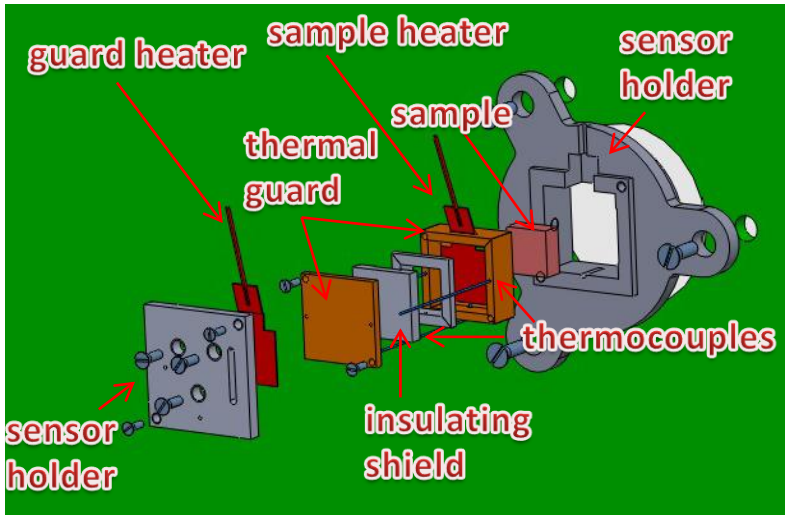
Convective heat transfer enhancement is critical in several industrial applications (e.g. electronic cooling). In our activity we:

- Design micro-structured patterned surfaces manufactured by both innovative and traditional techniques (Direct Metal Laser Sintering, laser etching, milling)
- Test them in air wind tunnel, where local average convective heat transfer coefficient is measured by an home made purposely developed sensor
- Study the fluid dynamic interaction between surface and air boundary layer
- Develop predictive models based on theory of turbulent flow, for estimating the heat transfer performances and optimize the surface features

Air wind channel and measurement chain



Example of micro-structured surface. More than 250 micro-cones have been built on this 1 cm^2 surface

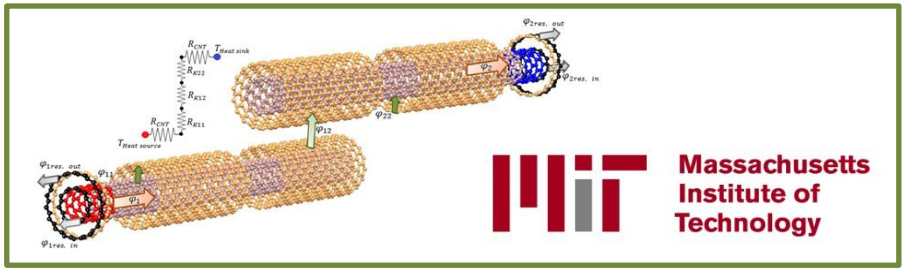


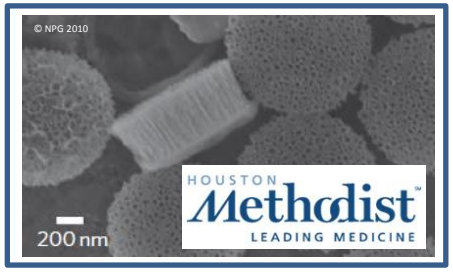
Convective heat transfer sensor exploded view

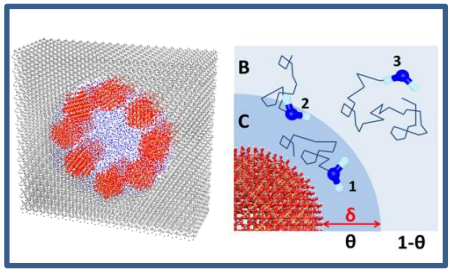
Mass and heat transfer in nanoconstructs for energy and biomedical applications

A better physical understanding of mass and heat transfer at the nanoscale is essential for the rational design of novel nanoconstructs for biomedical as well as for energy applications. Both nanoscale transfer phenomena are strongly influenced by solid-liquid nonbonded interactions occurring at the interface. Molecular Dynamics simulations are used for unveiling the peculiar physics of transfer phenomena at the nanoscale.

1 – Optimization of solid-solid heat transfer at the nanoscale, for enhancing the heat conduction properties of carbon-based fillers for thermal accumulation devices

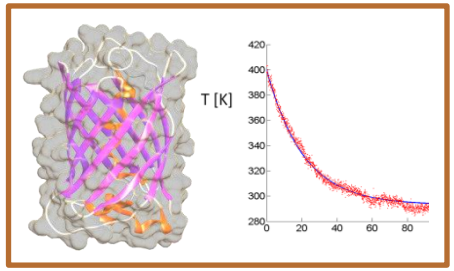


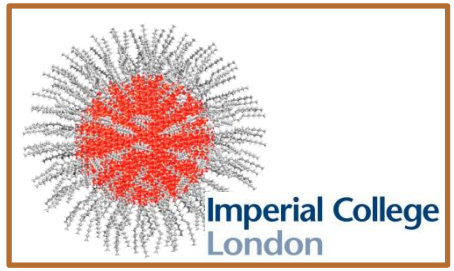


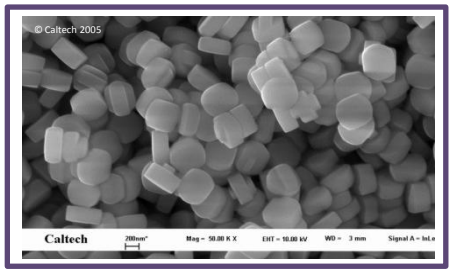


2 – Investigation of water transport in the proximity of nanosized solid surfaces, for a more rational design of thermal nanofluids

3 – Modeling of heat transfer at nanosized solid-liquid interfaces, for better understanding biological processes (e.g. water-protein interaction) or designing more performing thermal nanofluids







4 – *In silico* determination of design guidelines for low pressure zeolite-based adsorption materials, by tuning the introduction of defects/impurities in the crystalline structure