# Phase change dispersion for air conditioning applications

Location

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Keywords: Phase change material emulsions, heat transfer, fluid mechanics, thermodynamics

Context and scientific objectives

Phase change material emulsions (PCMEs) are latent functionally thermal fluids (LFTF) that can be used as secondary refrigerant for air-conditioning applications. They consist of a Phase Change Material (PCM) dispersed in a carrier fluid, usually water. Paraffin waxes are the most common PCM candidates in emulsions due to their multiple advantages. They are safe, stable, reliable and chemically inert. Such a kind of emulsion has a higher apparent specific heat than conventional single-phase fluids, and an enhanced heat transfer rate, due to the phase change of the paraffin. However, this potential may be restricted by the major drawbacks of the emulsion, namely a possibly strong supercooling and a, relative to water, higher viscosity.

Therefore, the objectives of the thesis are to define a series of new secondary fluids with different concentrations of surfactant, different types of PCM and formulate / prepare them but also to perform analytics: DSC, stability, rheology, PSD and T-History. This part will be performed at HSLU. In addition, the PhD student will carry out heat transfer tests for measuring heat transfer coefficient during cooling and perform rheology tests (CETHIL). Experimental results and modelling shall be used to apply Nusselt Correlations.

The scientific issues that should be addressed during the PhD are the following:
1- Understanding and modelling Prandtl numbers for Nusselt correlations and for discussing the concept of fully developed / developing flow
2- Better understanding and preventing Supercooling of PCME
3- Temperature and shear rate dependence of viscosity, measurements and modelling
4- Effect of surfactant and types of paraffin on heat transfer and rheology

Supervision: Prof. Rémi Revellin and Prof. Jocelyn Bonjour who belong to CETHIL and Prof. Dr. Ludger Fischer from HSLU

Grant: The salary will be adapted to the standards of living of the country for each period of time spent in each country (France and Switzerland). Planed is about 50% in Lyon and 50% in Lucerne.

Candidate profile: The candidate should be graduated (Master) and have good basis in thermodynamics, heat transfer and fluid mechanics. The candidate should have good practical skills. A first experience in research will be appreciated. The candidate should be fluent in English. German and French is of advantage. In order to promote equal opportunity, female scientists are explicitly invited to apply.

Procedure:
Send by email your CV and your motivation letter

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