**Theoretical Study on the Microencapsulation of AlSi for Applications in Liquid Metal-Based Packed-Bed Storage Systems**
**(Theoretical) Bachelor's Thesis / Master's Thesis**

Liquid metals, such as aluminum, lead, sodium, tin, and their alloys, serve as efficient heat transfer carriers over a wide temperature range due to their exceptional thermal properties. These metals are particularly advantageous for applications with high thermal loads due to their high thermal conductivity. Therefore, liquid metals are also considered as heat transfer fluids in thermal energy storage systems. However, the practical use of liquid metals is currently limited by their complex handling, specific component requirements, and significant corrosion issues. Ongoing research at the Karlsruhe Institute of Technology (KIT) and the German Aerospace Center (DLR) is addressing these challenges to improve energy efficiency and storage at high temperatures.
In a new collaboration, a storage system is to be developed that uses AlSi phase change material (PCM) together with liquid metals such as lead or tin as heat transfer fluids.

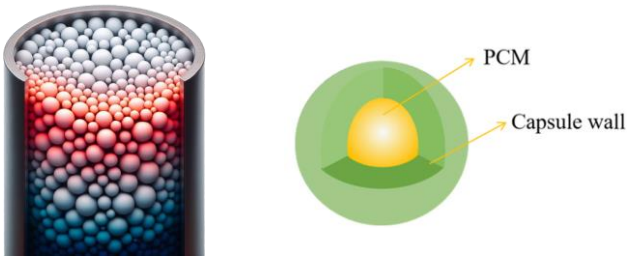


*Figure 1: Left: Representation of a packed-bed with spherical storage media, right: Simplified representation of a phase change material and its encapsulation*

In the proposed thesis, the following tasks should be addressed:

- Literature review on the current state of the art regarding micro- and macro-encapsulation methods
- Research and selection of suitable encapsulation materials that are compatible with the chosen PCM and liquid metals
- Presentation and discussion of the preliminary results at the DLR
- Numerical study using an existing MATLAB tool regarding the selected materials
- Theoretical evaluation of various capsule shapes, including a comparison between cylindrical and spherical encapsulation, and their impact on storage capacity and efficiency
- Summary of the results in a written report and a presentation

A personal meeting to introduce the topic is possible at any time. The specific tasks of the thesis can be adjusted to the individual interests of the student. For a bachelor's thesis, the scope will be reduced. The thesis is carried out at KIT, parts of the work can also be conducted from home by agreement.

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