

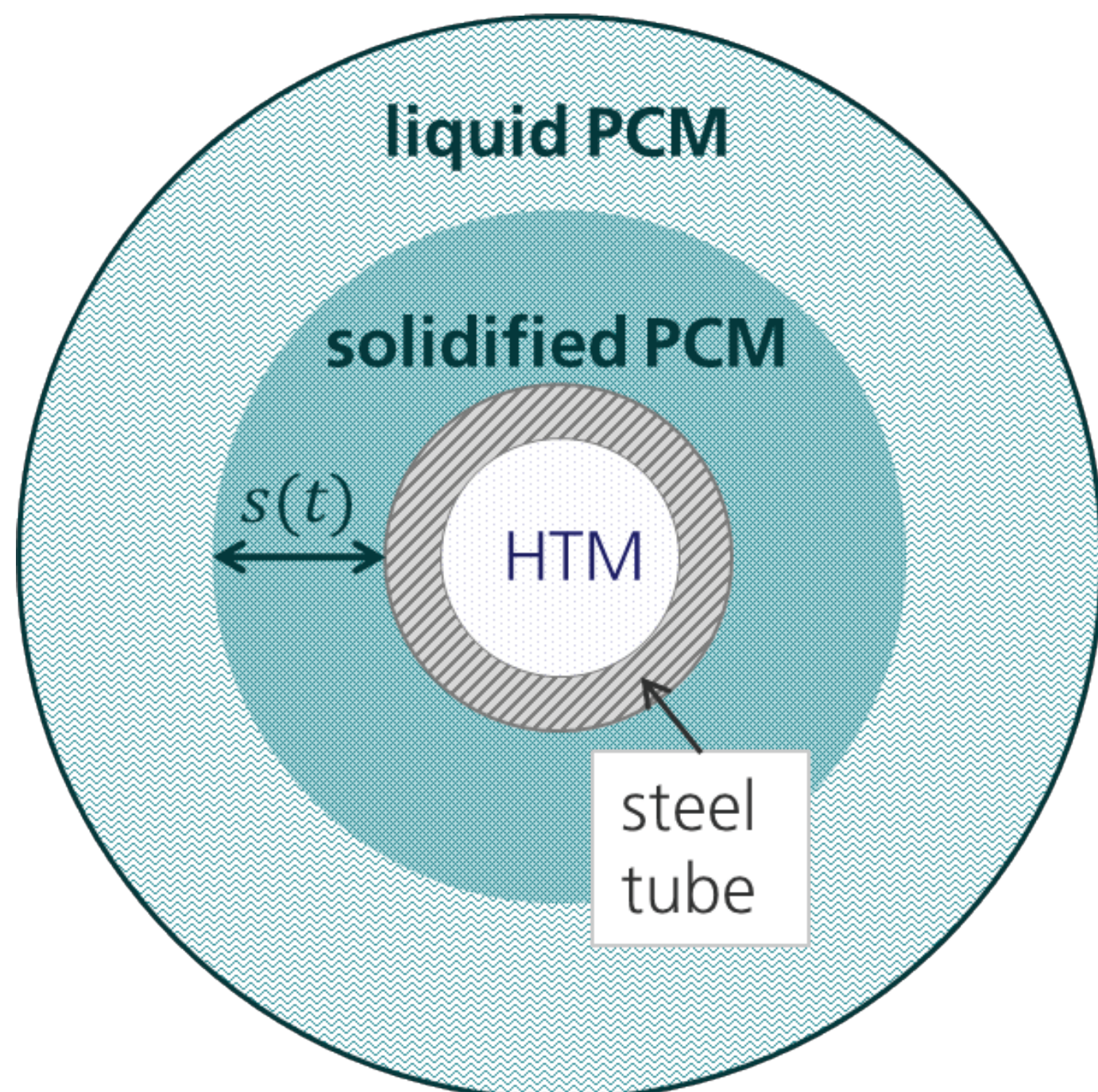


Fig. 1: Schematic of heat transfer

① Challenges: Heat transfer during discharging

Heat transfer from phase change material (PCM) to the heat transfer medium (HTM) decreases during discharging, due to the increasing layer of solidified PCM $s(t)$, and is related to the heat transfer area A , the temperature difference ΔT and the heat conduction in the solidified PCM λ_{solid} :

$$\dot{Q}_{\text{solid}}(t) \approx -\lambda_{\text{solid}} A \frac{\Delta T}{s(t)}$$

One possibility for increasing heat transfer is to increase the surface area over which the heat transfer occurs.

② Solution: Extended fins

Highly conductive materials such as aluminum or graphite are used to extend the heat transfer surface area, with the design being determined by power and capacity. Extruded aluminum can be assembled on steel tubes with spring clips, enabling independent thermal expansion of the materials.

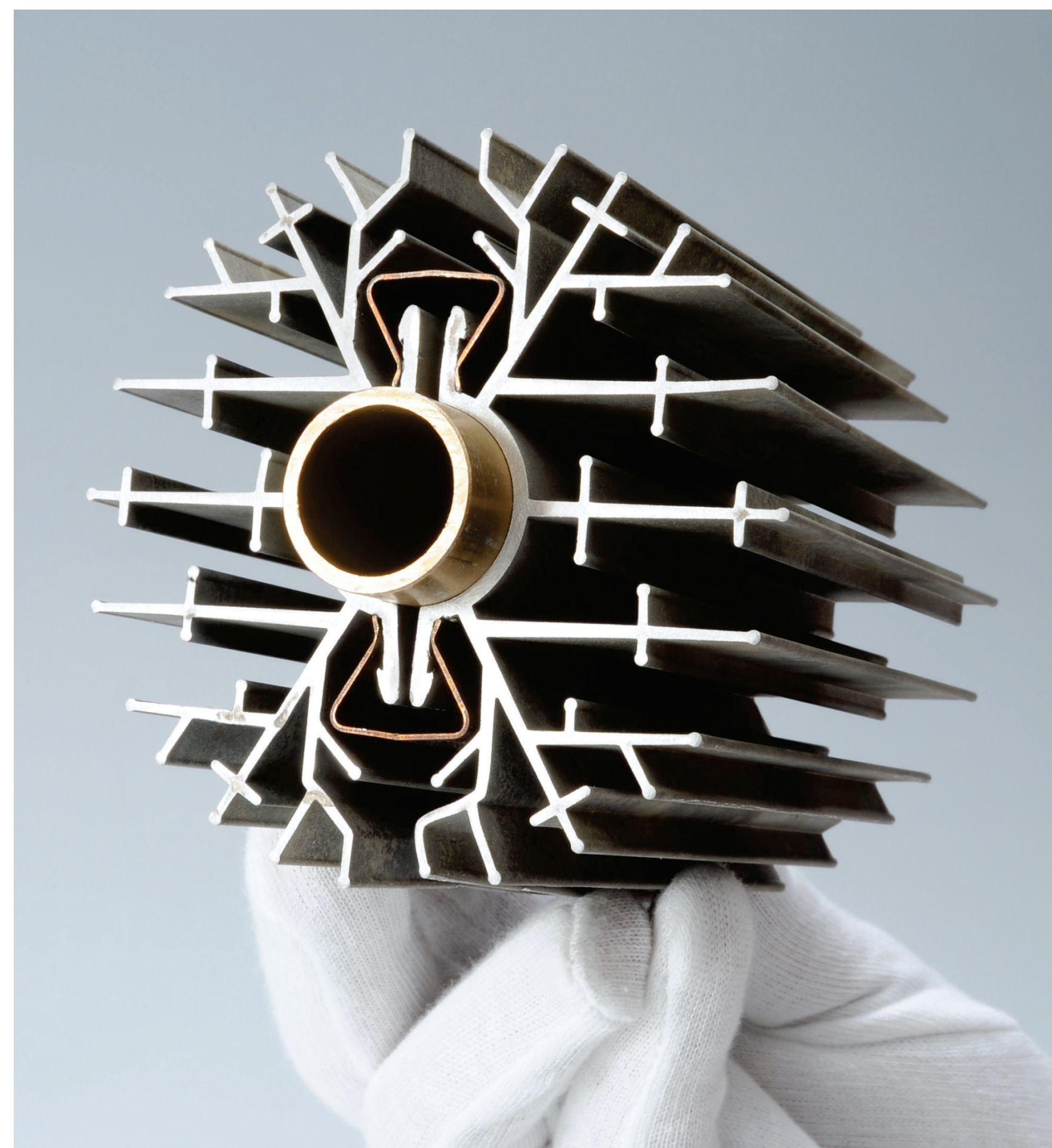


Fig. 2: Aluminum extended fins, on the right partially discharged

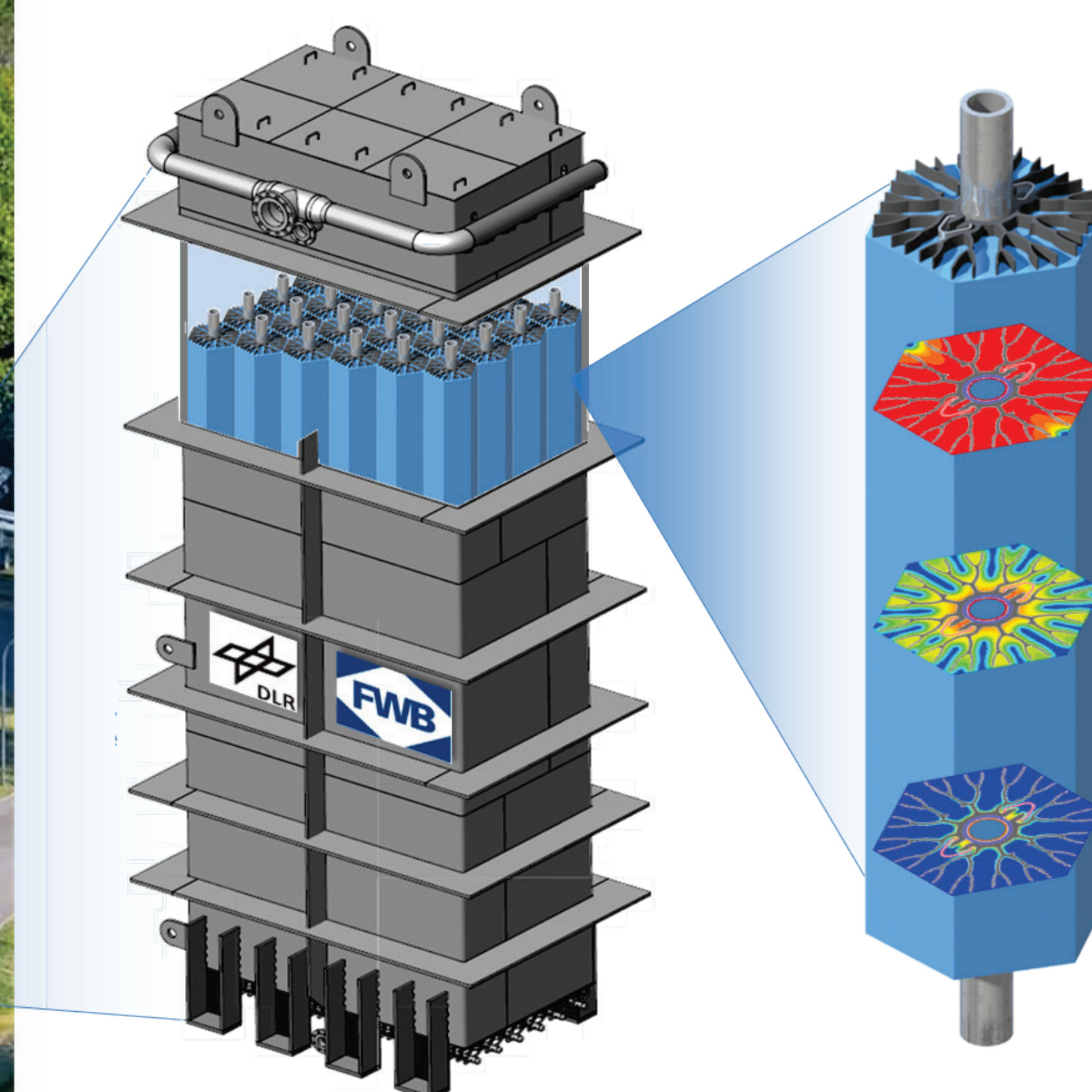


Fig. 3: Large scale latent heat storage using aluminum extended fins

③ Scale-up: Large scale storage design

Latent heat storages for large scale applications have been designed and tested using graphite or aluminum as well as radial or axial fins. Large scale testing up to 6 MW and 1.5 MWh has been and is being conducted to test real operating conditions and environments and to prove the feasibility outside of the lab environment.

