

Supplementary material – Novel freeze-casting device with high precision thermoelectric temperature control for dynamic freezing conditions

Cathrine D. Christiansen,^{1, a)} Kaspar K. Nielsen,¹ and Rasmus Bjørk^{1, b)}

*Department of Energy Conversion and Storage, Technical University of Denmark,
Frederiksborgvej 399, DK-4000 Roskilde, Denmark*

Additional close-up photos of the freeze-casting device, along with photos illustrating the styrofoam box and insulating foam used during operation to ensure a low and consistent ambient temperature. The dimensions of an LCSM freeze-cast sample is also illustrated.

^{a)}Electronic mail: cadech@dtu.dk

^{b)}Electronic mail: rabj@dtu.dk

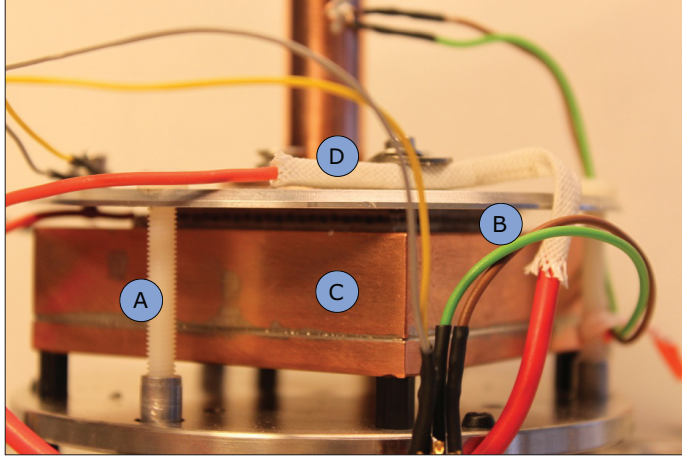


FIG. 1: A: Plastic screw, B: Peltier element, C: Heat exchanger, D: Fuse. The Peltier element is sandwiched between a heat exchanger and an Al-disk. The Al-disk is clamped lightly with plastic screws to the bottom steel plate. The plastic screws ensure flexibility during operation allowing thermal expansion or contraction of the various components.

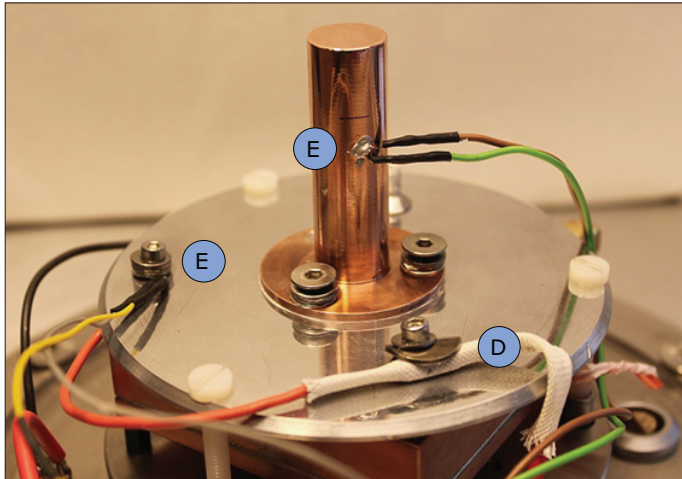


FIG. 2: D: Fuse, E: Pt-100 elements. The temperature at the topmost Pt-100 element is continuously fed to the control software and adjusted according to the PID settings.

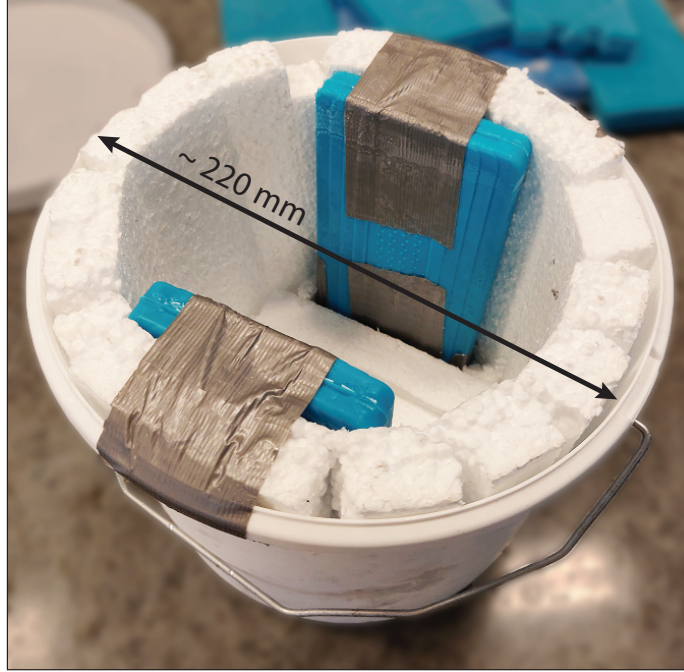


FIG. 3: Styrofoam box mounted inside a plastic bucket for ease of use. The insulating styrofoam and cooling elements ensures that the ambient temperature during casting is consistently below ~ 280 K.



FIG. 4: 15 mm insulating foam is wrapped around the mould during casting. The mould was moreover equipped with a 15 mm insulating foam lid. Note that the suspension in the given image is from a fairly viscous suspension which have stained the mould.

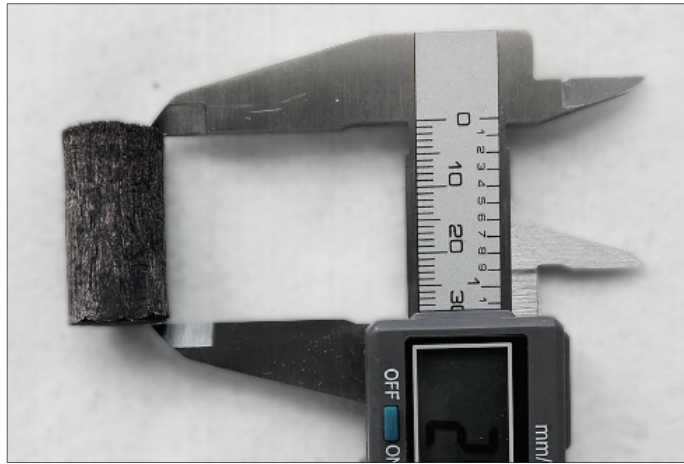


FIG. 5: A typical LCSM freeze-cast sample of ~ 30 mm length.