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A compact high-temperature furnace for SANS magnets

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Many modern high performance alloys feature ferromagnetic elements like Co or Ni. With SANS being a principal technique to investigate the nanostructure of these compounds in in-situ conditions, the ever present magnetic scattering can be of similar magnitude as the nuclear signal. Magnetic fields combined with high temperatures can hence be a key ingredient for studies of Co or Ni based superalloys or Steel samples.
We present a prototypical furnace that has been designed to fit the small-scale dimensions (80mm bore) of the available 2.5T magnet at SANS-1, MLZ. The innovations lie in a light-weight and compact design, with watercooling utilizing a 3-D printed Copper structure that is press-fitted to the aluminum dewar. The heating mechanism is based upon often-applied Joule heating of Nb-foils, although the implemented elements differ considerably in size from existing ones. The internal scaffold is exclusively made of ceramics, which display ideal thermal stability, electric and magnetic irresponsiveness. Samples with sizes of 10mm are anticipated.
Preliminary testing has confirmed the benchmarks set by previous ovens in the regime of 1000°. Simulations predict a possible temperature of more than 1700°. A run with maximum power however is still a work in progress due to safety measures.
The oven, by its small size and application to metallurgic samples, also makes excellent use of the *SANS-1MAX* upgrade program that is planned for the upcoming years.

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