

# Thermal Stability of commercially available Coated Conductors

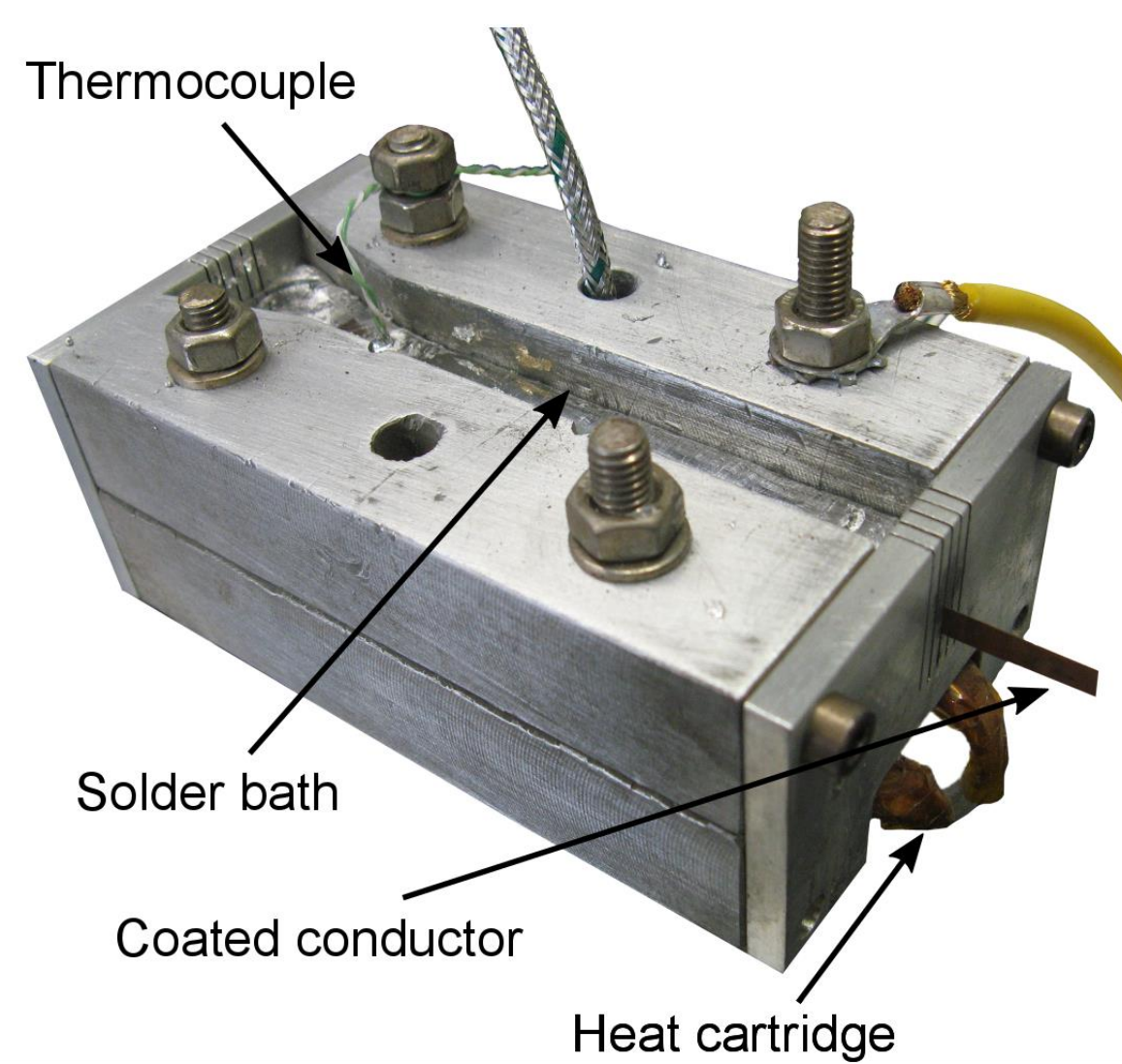
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## Motivation

- Soldering is a standard process in manufacturing of superconducting applications
- Thermal load during soldering can lead to degradation of coated conductors
- Precise degradation behavior of coated conductors in the temperature range between 200°C and 300°C so far largely unpublished

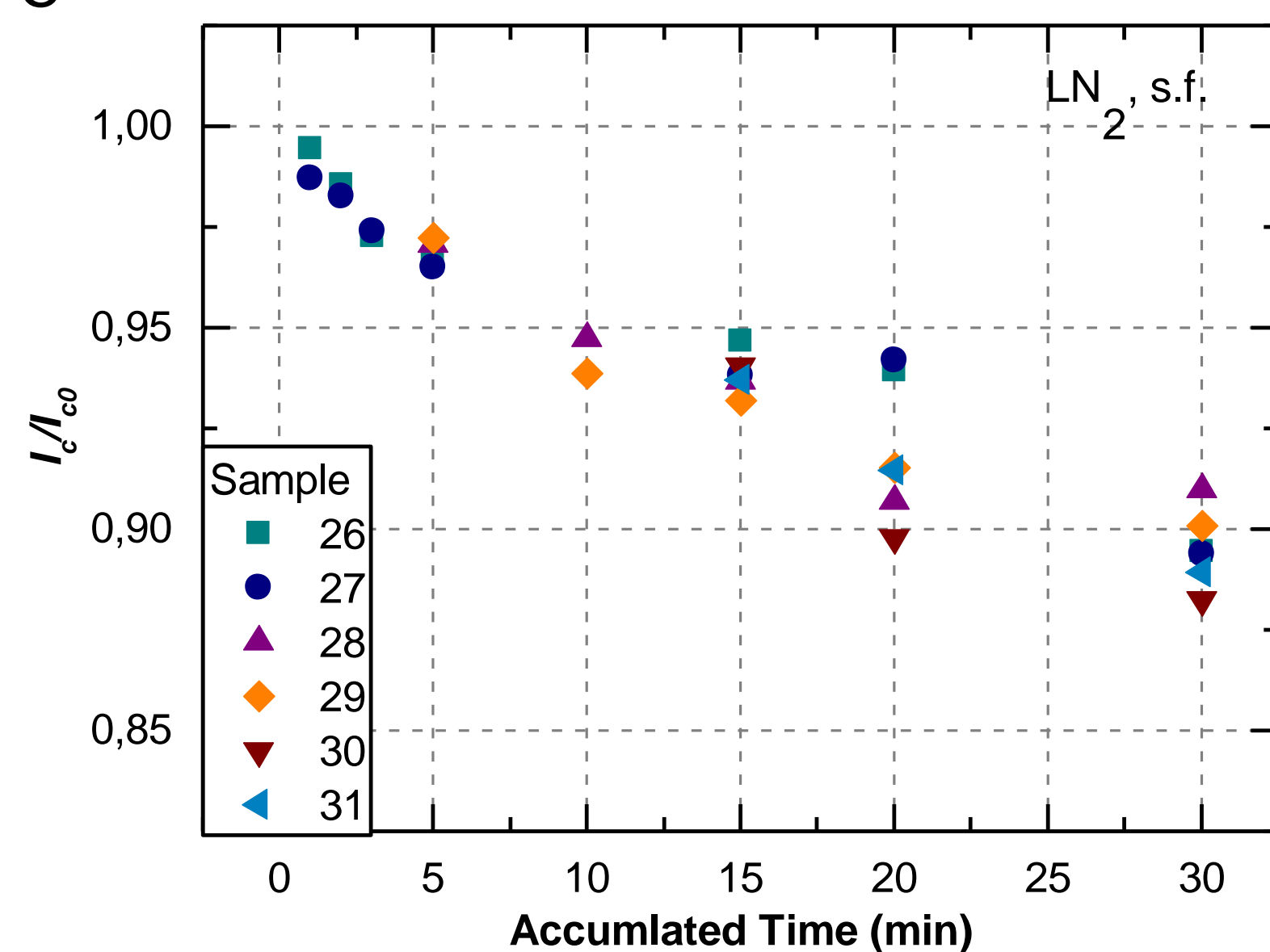
## Heat treatment setup

- Aluminum block with heating cartridges
- Up to 3 samples in 63Sn37Pb solder bath
- Type K thermocouple as bath temperature sensor
- Temperature varied  $\pm 2,5^\circ\text{C}$  around the set temperature



## Thermal cycles

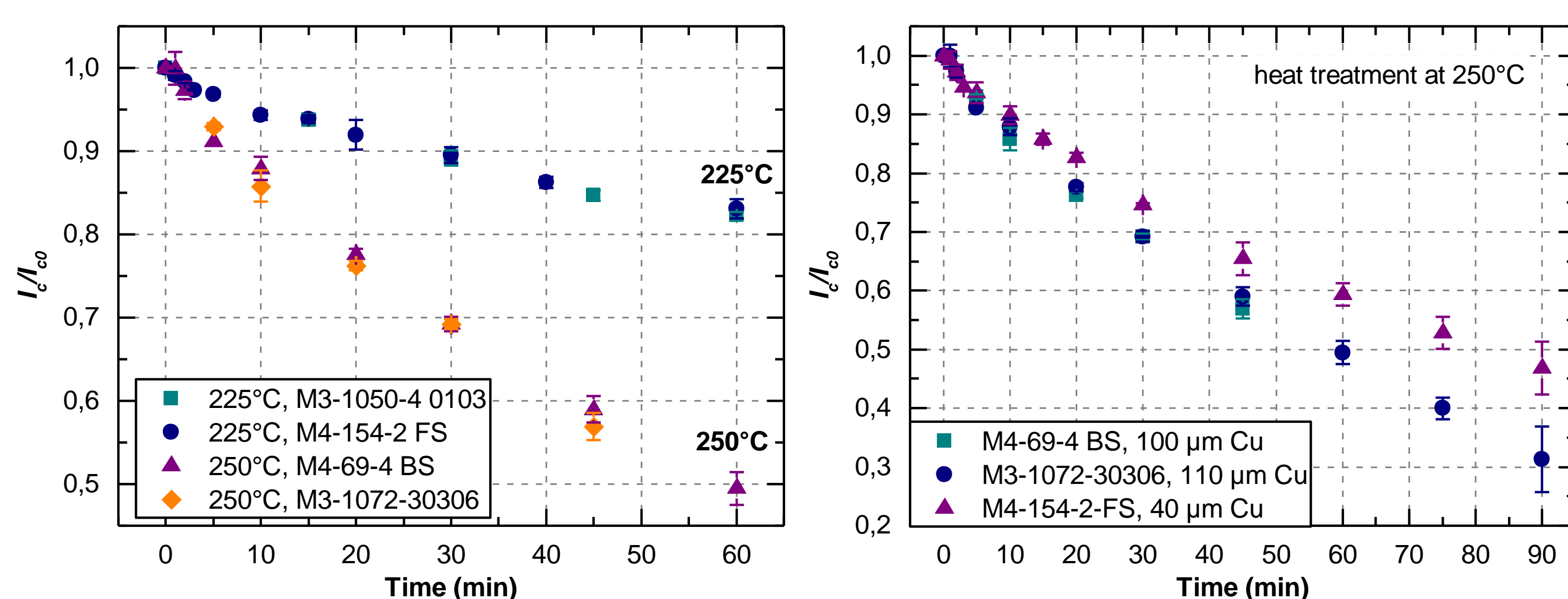
- Shown: Critical current degradation of samples with a varying number of thermal cycles at 225°C



- Critical current degradation depends on time at elevated temperature, independent from the number of thermal cycles
- Subsequently samples were reused in the investigation

## $I_c/I_{c0}$ behavior of various production batches

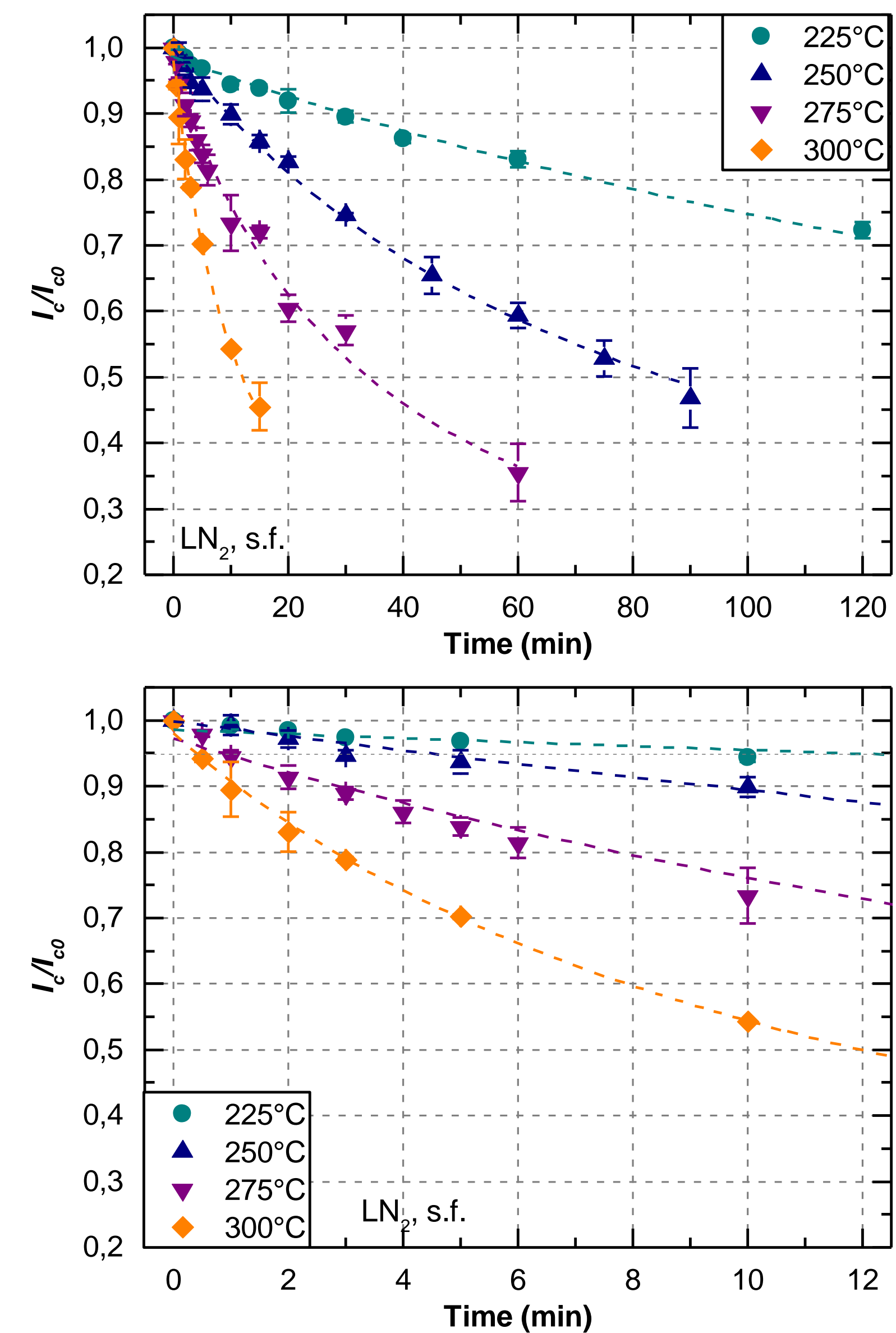
- Shown: Critical current degradation as a function of time at 250°C for three different production batches from SuperPower Inc.



- No difference was measured between batches with similar stabilizer thicknesses
- A batch with thinner stabilizer degraded noticeably less at longer durations

## $I_c$ degradation as a function of time

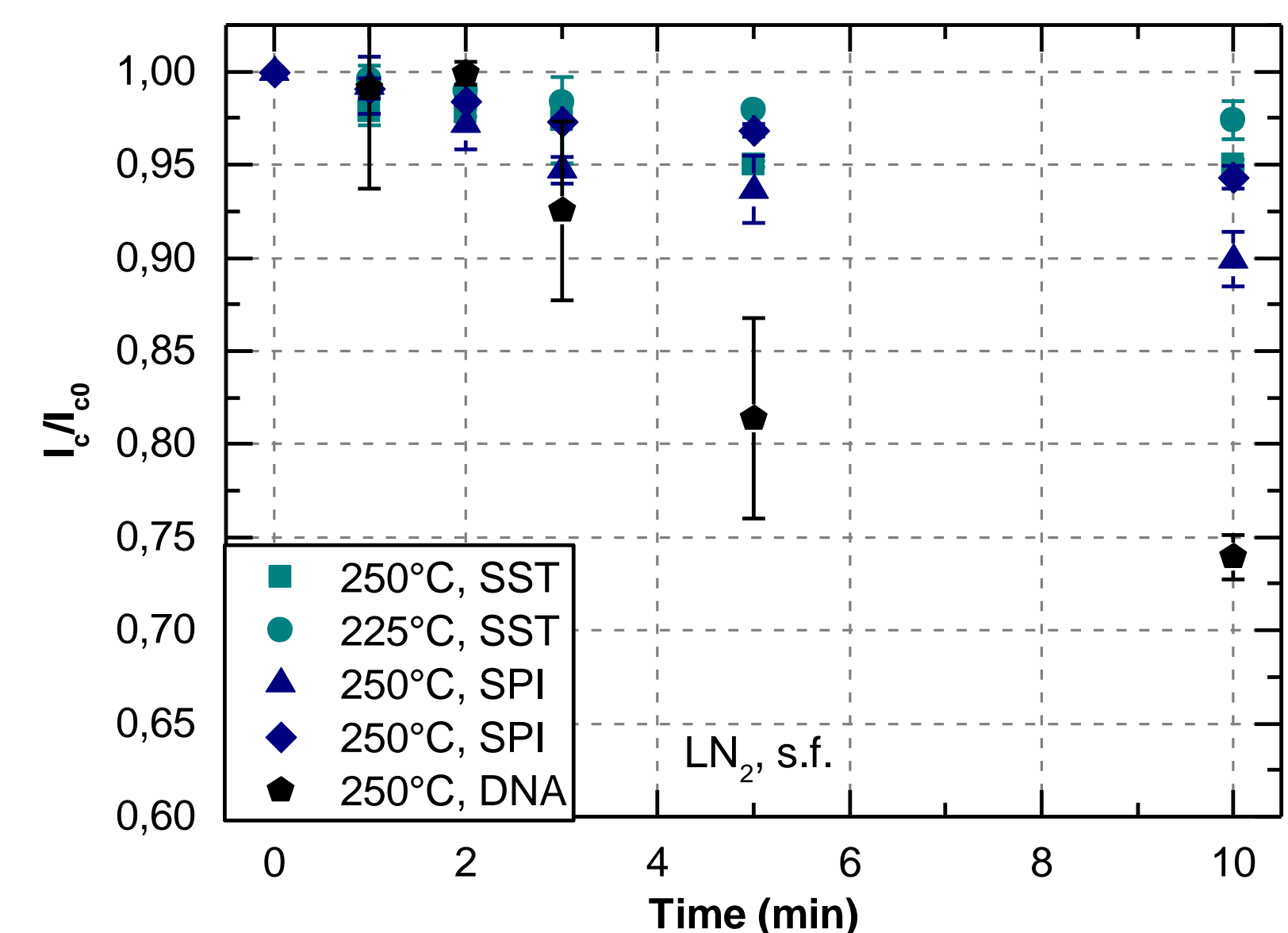
- Shown: Critical current degradation as a function of time between 200°C and 300°C for SuperPower tapes



- Degradation is strongly dependent on the temperature and time e.g. 10 % degradation after only 1 min at 300 °C. At 250°C 10 % degradation requires about 10 min

## $I_c$ degradation of three manufacturers in comparison

- Shown: Critical current degradation of the manufacturers SuperPower Inc (SPI), Shanghai Superconductor Technologies (SST) and Deutsche Nanoschicht (DNA) for up to 10 min at various temperatures



- For short durations all manufacturers have a similar behavior
- Slight variations among the manufacturers can be observed at longer durations

## Summary and outlook

- Critical current degradation depends on time at elevated temperature, but appears independent from the number of thermal cycles
- Slight variations in the  $I_c$  degradation between tapes with different stabilizer thicknesses were measured
- A strong dependence on temperature and time can be observed
- For short duration degradation among different manufacturers appears similar
- Impact of stabilizer thicknesses needs to be further investigated as well as the impact of e.g. the heat up time