

Critical current measurements and determining axial stress limit of Ag/Bi2212 round wires using ITER barrel configurations

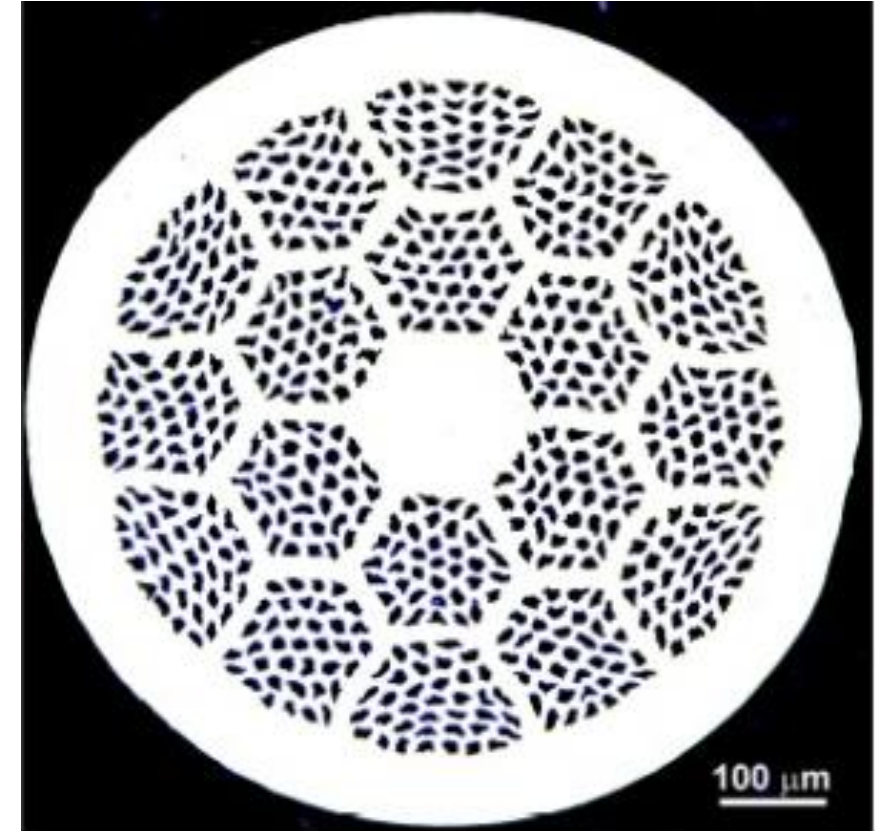
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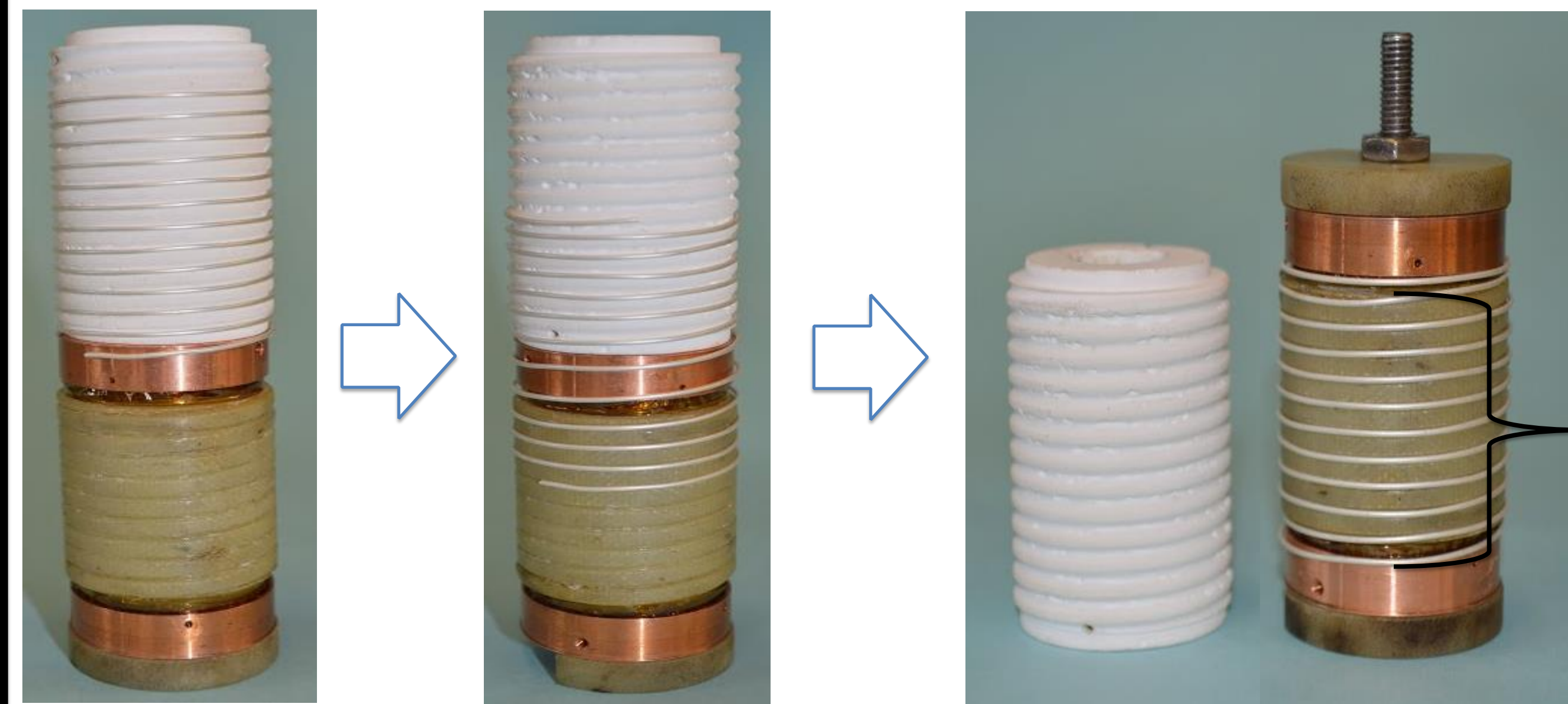
Traditionally, critical current of Ag/Bi-2212 strands is measured using short straight samples on G-10 sample holders. This work explores a new test protocol using a spiral wound from ~1 m long wire. Using high-critical current Bi-2212 strands made by overpressure processing, we show that this method produces reliable results consistent with the traditional method using several barrel materials, and that it introduces an alternative way of determining axial stress limit for Bi-2212 strand.

Step 1: Heat treating Bi2212/Ag round wire on a Al₂O₃ Barrel

OST 0.8 mm wire, 37x18 wire architecture, PMM101108-1

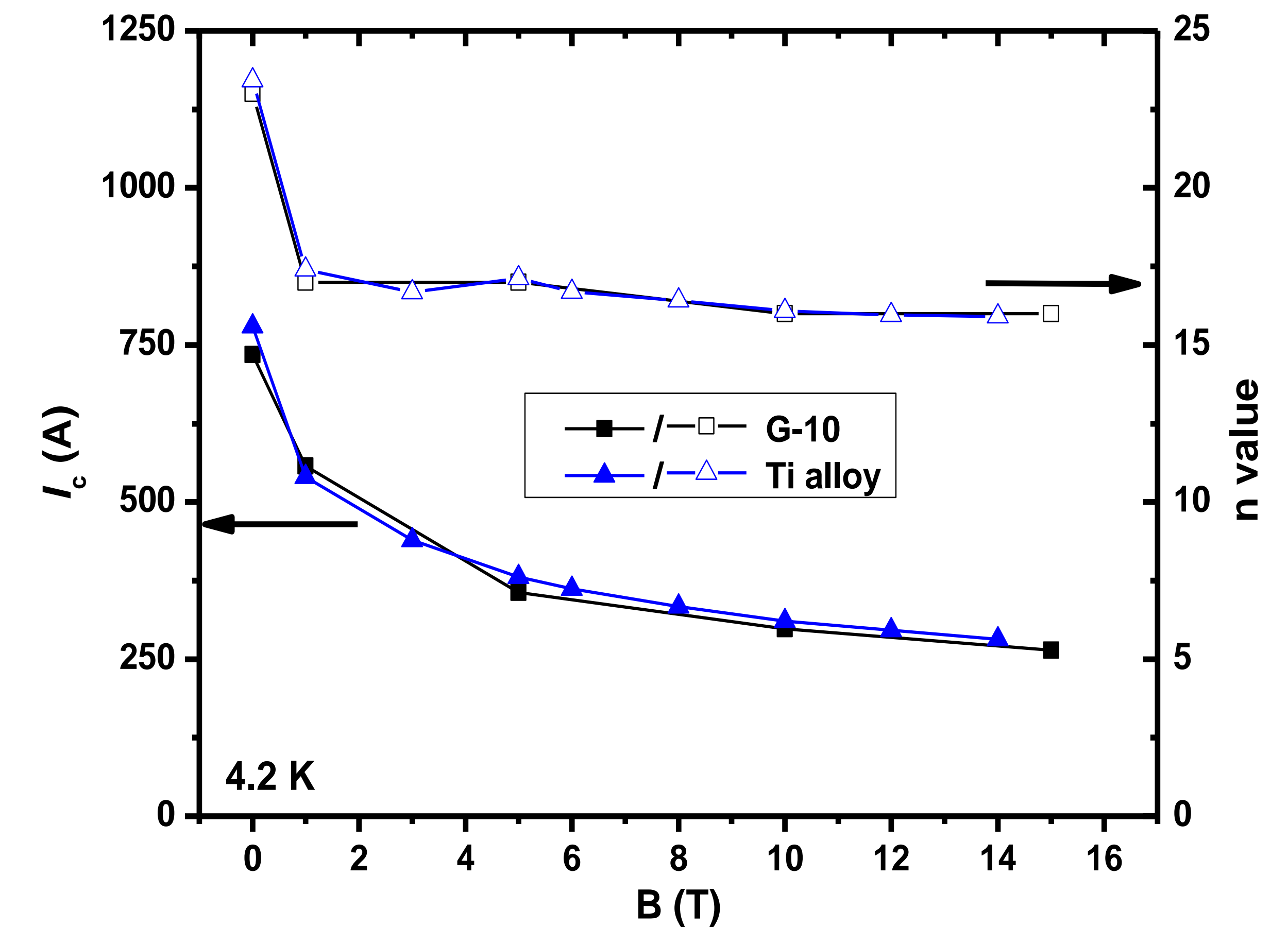
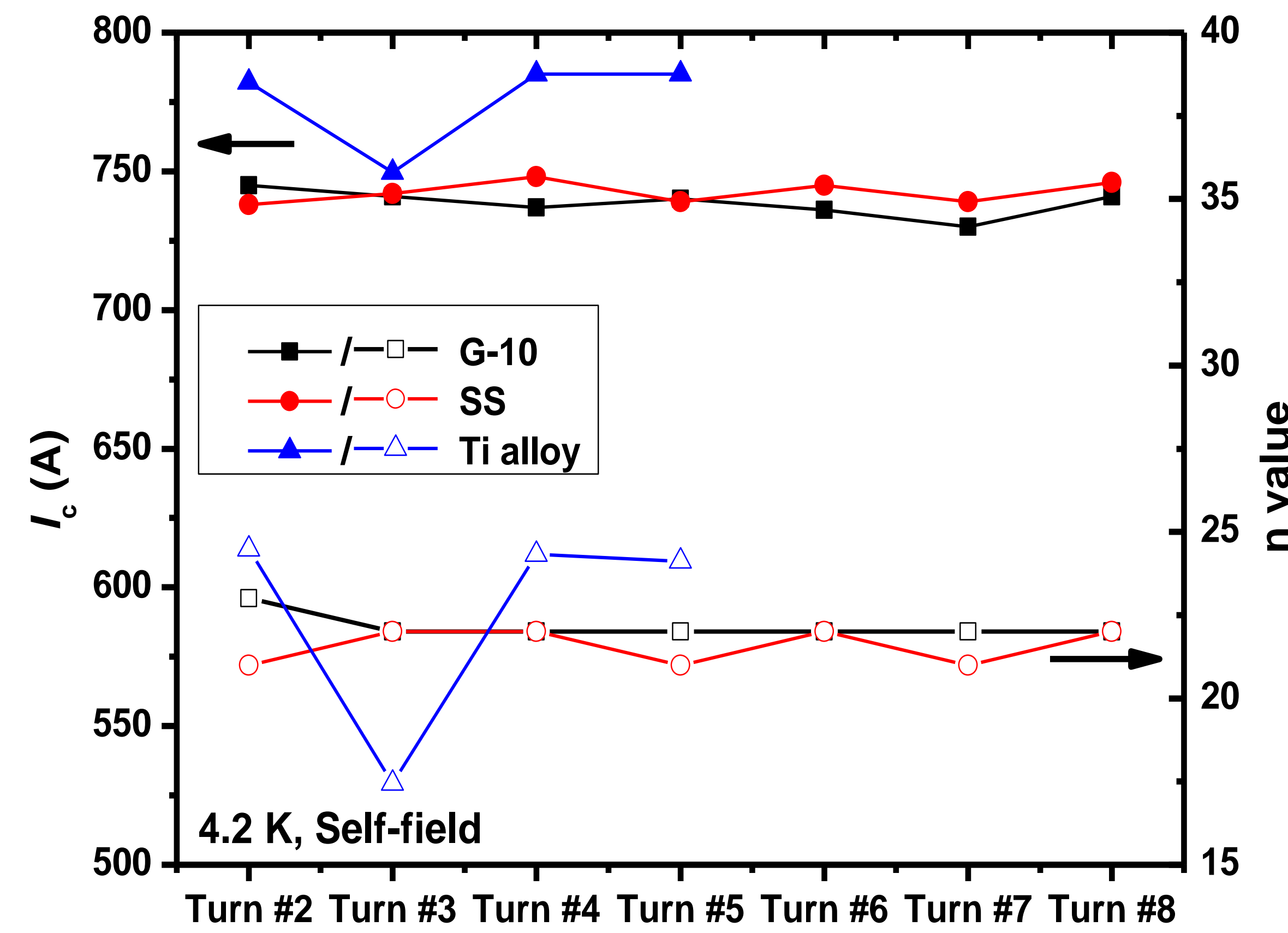


Step 2: Transferring samples to a test barrel after reaction



Effective Conductors for I_c measurement: 1 m long as 9 turns

All testing barrels produced I_c results consistent with short straight samples



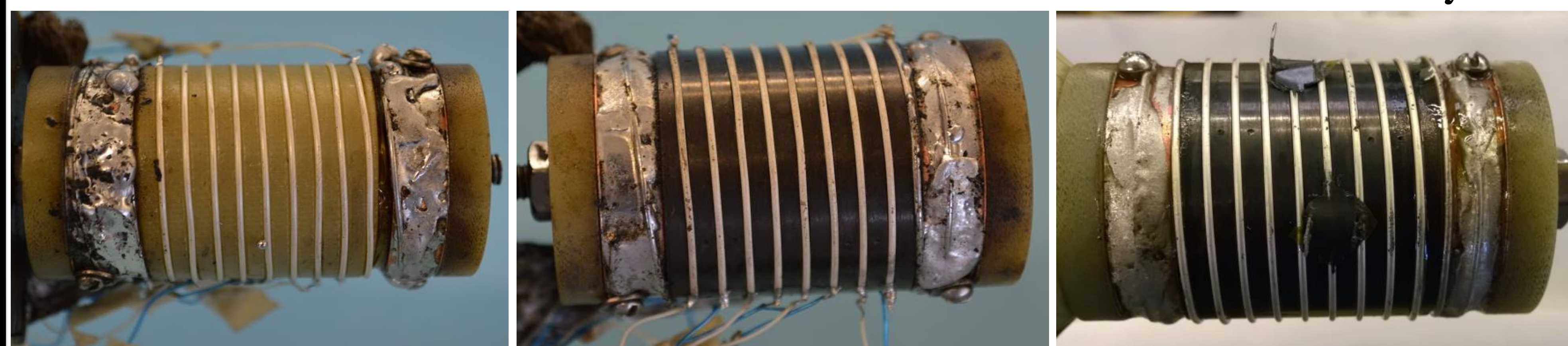
I_c of short, straight samples measured on G-10 sample holder has an average of 693.3 A and a standard deviation of 37.5 A. All of the samples were prepared using a 25 bar overpressure partial melt processing.

Three test barrel materials investigated

G-10

Stainless Steel 304

Ti-6Al-4V alloy



THERMAL CONTRACTION FROM RT TO 10 K

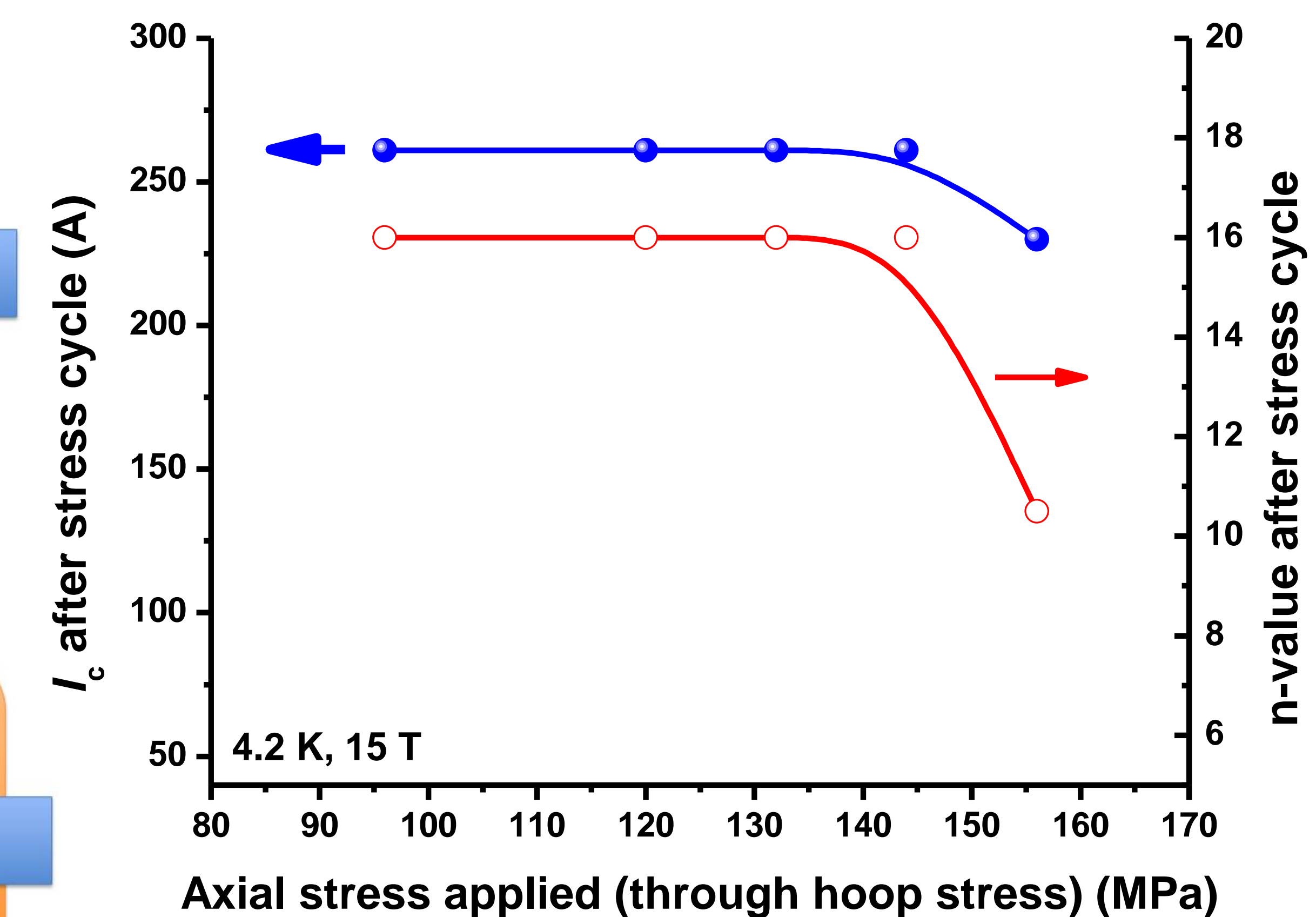
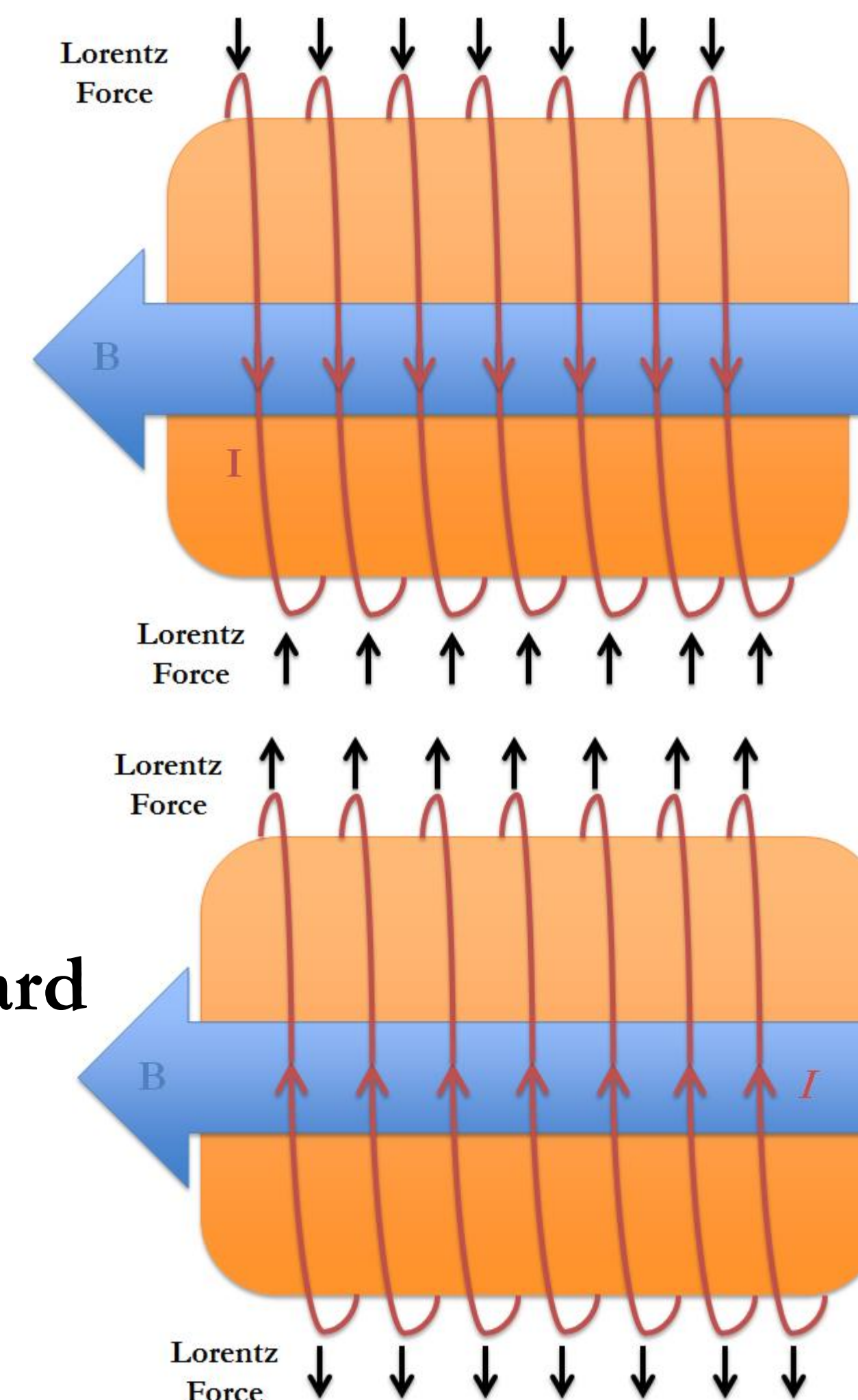
Material	$\Delta L/L$ %	Material	$\Delta L/L$ %
Stainless Steel 304	-0.30	Ag	-0.41
Ti-6Al-4V	-0.17	Bi2212 a,b-axes	-0.15
G-10 (wrap)	-0.25		

The difference on thermal contraction between barrels could potentially differ the Bi2212/Ag wire's strain state when cooling to 4.2 K from RT.

Determining the axial stress limit of a Bi-2212 strand

I_c test mode – Lorentz force pointing inward and zero hoop stress applied

Stress limit testing mode: Lorentz force pointing outward and hoop stress applied as $\sigma = Bjr$.



5% I_c degradation with an axial stress of 156 MPa at 15 T