Quantum Design

Dilatometer

DynaCool (D680) / PPMS (P680)

For quantifying a sample's thermal expansion coefficient or probing magnetostriction effects, the Dilatometer offers unparalleled resolution and convenience. The dilation is determined by rigidly coupling a sample's expansion/contraction to the distance between the plates of a capacitor. Further, a ratiometric voltage measurement renders a large costly absolute capacitance bridge unnecessary, while the fused-silica cell design requires no first-order corrections due to adsorbed gas, thermal gradients, or applied magnetic field.

Dilatometer Specifications (for zero-field)

Dilation [ΔL]	
Resolution:	$<$ 10 pm, @ 2 K
Noise Floor:	$<$ 20 pm, @ 2 K
$\Delta L/L$ Resolution:	10^{-9}, for 2 mm wide sample
Background Dilation:	$<$ 250 nm (300 $\rightarrow$ 2 K)
	$<$ 300 pm (0 $\rightarrow$ 9 T), @ 2 K
Sample Space Parameters	
Ideal Sample Size*:	2 $\pm$ 0.05 mm × 2.5 mm × 3 mm
Operational Range	1.8 to 400 K; 0 to 16 T

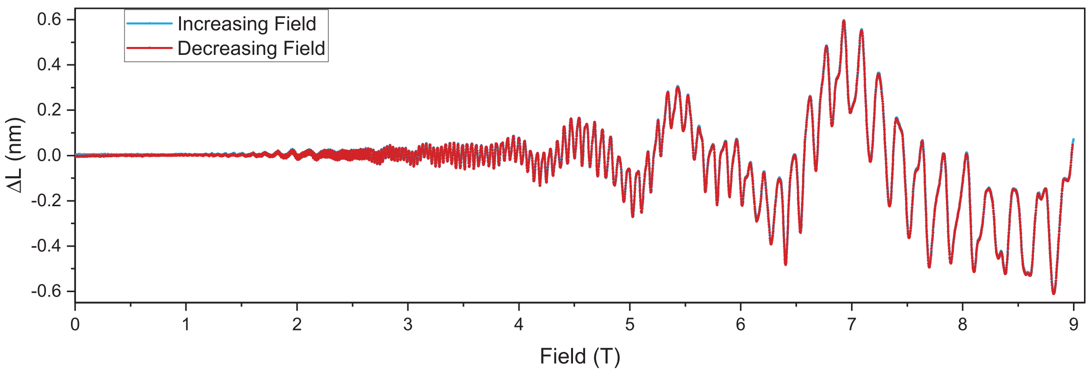
*For samples narrower than 2 mm, included shims can be used; other dimensions are not tightly constrained.

Specifications are subject to change without notice.

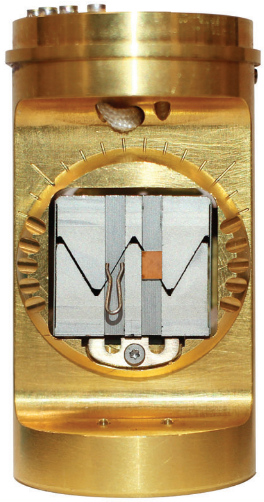
Key Features

- Lapping tools for sizing samples to the ideal width (2 mm) included along with measurement electronics, probe, and cell hardware
- Provided balance meter allows users to confirm proper sample sizing by a direct measurement before hardware is installed in the PPMS
- Manual rotation (rotation axis normal to the direction of applied field) of the sample within the cell between -20° and +110° outside of the PPMS enables systematic anisotropy studies
- Fused silica and copper reference samples included for periodic verification of system performance

Dilatometer Capsule installed in the Balance Meter



The change in length of a 2 mm long aluminum piece at 2 K is shown as a function of applied magnetic field; oscillations in dilation due to the de Haas-van Alphen effect can clearly be seen. The blue curve reflects data taken upon increasing the applied field, while the red curve corresponds to the subsequent decreasing of the field. In the 12 hours it took to collect the data, the total drift was on the order of only 10 pm (hence the red curve largely obscuring the blue).



Dilatometer Capsule with copper sample