

高精度膨胀计

在过去十年中，体积热膨胀系数被认为量子临界现象分析的有利工具。而且最近该现象从理论研究阶段向实验阶段发展，可用于低温和强磁环境下的微型膨胀计成为科研工作者所必须的工具。

为了解决该问题，上海昊量光电推出来高精度微型膨胀计，该设备可用于在低温和强磁环境下对物体的磁滞伸缩和尺寸变化。该夹具可用于 10mk 到 320K 的低温环境，最大磁场可达 40T。测量分辨率可达 0.02 埃。



为了减小温度变化磁场对夹具的影响，采用铍铜合金构成由整块的皮铜合金通过电火花切削而成，使其拥有紧凑的体积。结构如下：

- 1) 活动部分；
- 2) Be-Cu 簧片；
- 3) 夹具固定部分；
- 4) 样品；
- 5) 上部电容器；
- 6) 下部电容器；
- 7) 上护环；
- 8) 下护环；
- 9) 调节螺丝；
- 10) 活塞；
- 11) 蓝宝石垫圈；
- 12) 绝缘片

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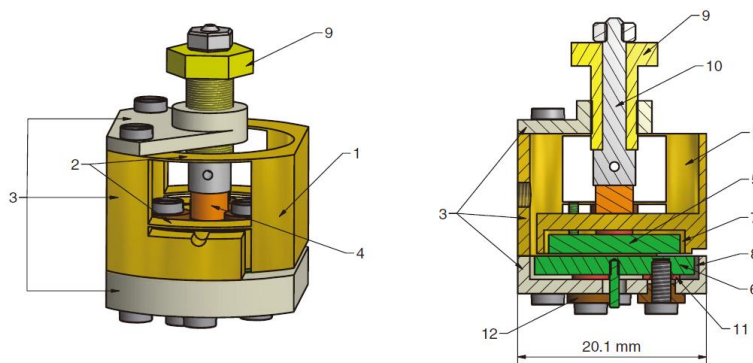
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上海昊量光电推出的膨胀计主要包含以下三种产品：

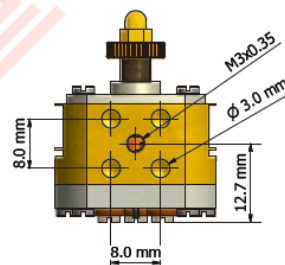
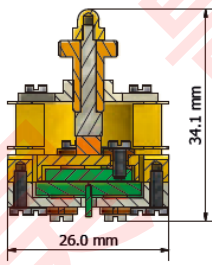
1) 标准膨胀计 (Standard-Dilatometer)

标准膨胀计是用于磁致伸缩和热膨胀的电容膨胀计。

Side cut-away view

Front cut-away view

Back view



Size and Dimensions		Measurable sample size	
footprint; height	20 mm × 26 mm; 34 mm	footprint (max.)	(3.5 mm × 10 mm) or Ø = 5 mm
weight	45g	height	Less than 1 mm up to 5 mm
Absolute resolution		Materials	
@ low Temperature (Kelvinox-Systems (0.01 K up to 6 K))	$\Delta L = 0.02 \text{ \AA}$	Dilatometer-parts	copper beryllium
@ PPMS	$\Delta L = 0.1 \text{ \AA}$	Insulating pieces; washers	vespel; sapphire
Range of operation		Options	
Temperature range	10 mK < T < 320 K	Variety of Cryostats	Dilatometer + attachments
Magnetic field range	At least up to 30 T (max. tested field)	PPMS	Dilatometer complete with PPMS-probe and cables + software

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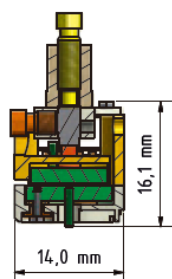
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Reference: Rev. Sci. Instrum. 83, 095102 (2012) A compact and miniaturized high resolution capacitance dilatometer for measuring thermal expansion and magnetostriction

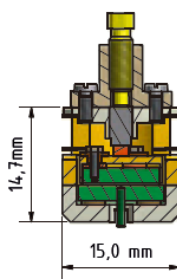
2) 小型膨胀计 (Mini-Dilatometer)

是目前市面上比较小的电容膨胀计用于高分辨率热膨胀测量和高磁场下磁滞伸缩测量。

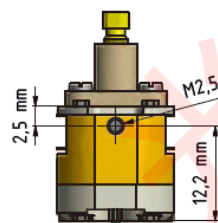
Side cut-away view



Front cut-away view



Back view



Size and Dimensions		Measurable sample size	
footprint; height	14 mm x 15 mm; 16 mm	footprint (max.)	(2.3 mm x 6 mm) or $\varnothing = 3.3$ mm
weight	13g	height	Less than 1 mm up to 2.75 mm
Absolute resolution		Materials	
@ low Temperature (Kelvinox-Systems (0.01 K up to 6 K))	$\Delta L = 0.01 \text{ \AA}$	Dilatometer-parts	copper beryllium
@ PPMS	$\Delta L = 0.1 \text{ \AA}$	Insulating pieces; washers	vespel; sapphire
Range of operation		Options	
Temperature range	10 mK < T < 320 K	Any Cryostat	Dilatometer + attachments
Magnetic field range	At least up to 38 T (max. tested field)	PPMS	Dilatometer (can be rota- ted) complete with PPMS- probe and cables + software

Reference: Rev. Sci. Instrum., in press (2017) The world's smallest capacitive dilatometer, for high-resolution thermal expansion and magnetostriction in high magnetic fields

3) 应力膨胀计 (Stress-Dilatometer)

该单轴应力膨胀计是用于在多重极端条件 (例如: 低温、强磁、应力) 下对

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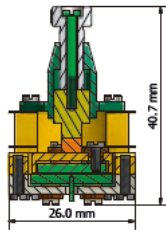
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热膨胀和磁滞伸缩的测量。

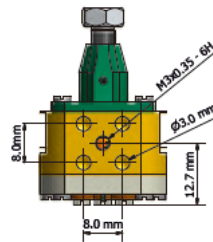
Side cut-away view



Front cut-away view



Back view



Size and Dimensions		Measurable sample size	
footprint; height	20 mm x 26 mm; 41 mm	footprint (max.)	(3.5 mm x 10 mm) or $\varnothing = 5$ mm
weight	52g	height	Less than 1 mm up to 5 mm mm
Absolute resolution		Materials	
@ low Temperature (Kelvinox-Systems (0.01 K up to 6 K))	$\Delta L = 0.02 \text{ \AA}$	Dilatometer-parts	copper beryllium
@ PPMS	$\Delta L = 0.1 \text{ \AA}$	Insulating pieces; washers	vespel; sapphire
Range of operation		Options	
Temperature range	10 mK < T < 320 K	Variety of Cryostats	Stess-dilatometer + attachments
Magnetic field range	At least up to 30 T (max. tested field)	PPMS	Dilatometer complete with PPMS-probe and cables + software
Range of operation			
Applied force	from 40 up to 75 N		
max. uniaxial stress	3 kbar for cuboid sample of (0.5 mm) ² cross section		

Reference: Rev. Sci. Instrum. 87, 073903 (2016) A uniaxial stress capacitive dilatometer for high-resolution thermal expansion and magnetostriction under multiextreme conditions

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