

表面力仪可以直接测量表面（无机、有机、金属、氧化物、聚合物、玻璃、生物等）之间的力学信号，在分子水平上研究界面和薄膜现象的静态和动态力。模块化设计与众多附件可供选择和定制扩展升级（见第3页）。



The SFA 2000 机体以及光学支架-
designed by Jacob Israelachvili

应用范围

研究领域以及可检测的相互作用力 *

分散科学 – 存在于液体表面和蒸汽的“胶体”力

附着力科学 – 远程的胶体力和短程的粘附力

表面化学 – 不同材料之间的表面和电化学相互作用

清洁,食品研究 – 表面活性剂与脂质单层和双层之间的作用力

生物材料和生物表面 – 蛋白质和聚合物修饰过的表面之间的力

生物医药相互作用 – 配体和受体、蛋白质和生物膜之间的相互作用

摩擦学 – 摩擦, 润滑和光滑或粗糙的表面磨损, 薄膜流变

粉末科技 – 互动作用过程中毛细效应和表面变形

材料研究 – 金属和氧化物表面和薄膜的机械性能以及失效分析

* 研究范围不局限于这个清单, 如有其它需求请联系我们。

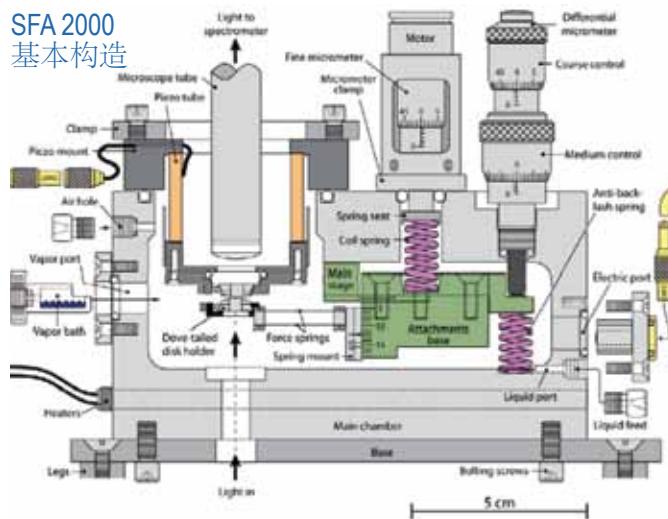
仪器概况

表面力仪测试存在于气体或液体中的两个光滑表面之间的力。灵敏度在纳牛级别，距离分辨率为0.1纳米。它可以测量表面之间的介质折射率、吸附等温线、毛细管冷凝等。表面力学方面，可以测试动态相互作用力，如粘弹性和摩擦力以及薄膜流变性，并可以观察分子（纳米）级别上表面变形之间介质折射率的实时变化。一些达到分子级平整度以及以上的硬材料都可以作为基底的光滑表面材料，比如云母、二氧化硅、蓝宝石、聚合物等；这些基底也可使用表面活性剂、脂质、聚合物、金属、金属氧化物、蛋白质和其它生物分子等进行表面修饰。

工作原理

下图是SFA2000的示意图。相互作用的两个表面，它们之间绝对分离开，吸附层表面的厚度通过白光干涉仪（精度0.1纳米范围内）分析光学干涉条纹来获得。靠近两个表面之间的距离是通过从毫米到埃级精度的四阶机械控制来实现。测力弹簧的刚度可以在实验过程中进行调整，以适应测量各种不同大小的力。动态测量在运动表面进行（垂直、水平或在三维空间中的任何方向），可以通过使用以下各页中描述的附件来实现。

SFA 2000
基本构造



SFA控制平台



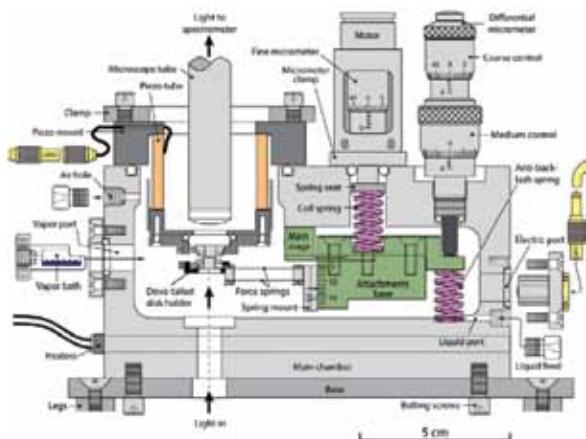
用途

表面力仪技术可以用于表征和量化各类在液体和气体中的两个表面之间的相互作用（参见第4页上的参考文献）。静电相互作用包括范德华力和静电力、溶剂结构变化产生的力（溶剂化和水合力）、毛细力、疏水相互作用力、聚合物介导空间的消耗力、表面活性剂的单层和脂质双层、附着力和特定生物基团之间的配对相互作用力。动态和实时相互作用力检测包括在超薄膜（纳米流变）、液体慢松弛、密闭的几何形状聚合物、靠近过程中的表面变形、两个表面之间的分离和侧向滑动。最近的应用包括食品技术、离合器、壁虎如何在墙壁和天花板爬行、贻贝的生物粘附以及关节的生物润滑。

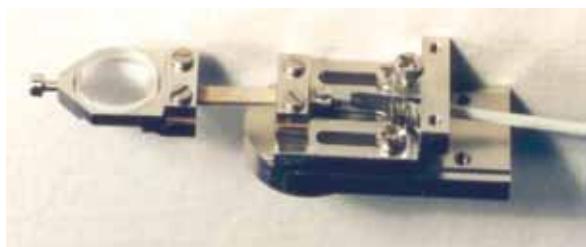
主要特点和附件

表面力仪精确测量力或存在于两种材料表面之间（空气，蒸汽或液体）任何形式的相互作用关系，包括其原有固定的几何形状和变形量，表面力仪可以非凡的将其直接测量并可视化，具备明确的（亚埃级）的精度和热漂移方面的稳定性。不像其他一些表面力学测量仪器，如扫描探针显微镜和摩擦测试仪，表面力仪使用白光干涉仪，可以精确检测表面在分离时的实时作用力，提供了在交互作用点时的实时局部变形几何形状。一些早期型号的附件（如SFA3）现在已是SFA2000的一部分，而且新的附件允许各种动态测量，例如，大范围的速度或剪切速率的摩擦，润滑和粘弹性力。四个附件如下图所示：

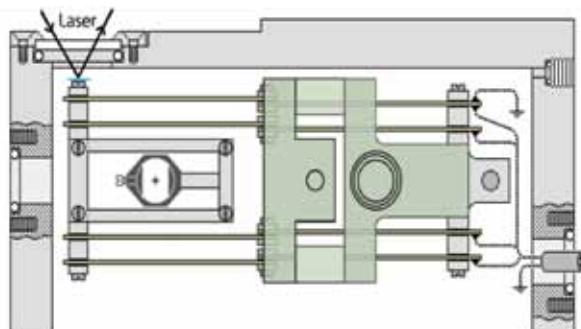
摩擦装置部件
用于摩擦与润滑研究



振动压电片
用于测试薄膜粘度



双压电滑片
用于薄膜高速剪切



液体池
用于研究生物表面（蛋白质等）



其他可定制的附件包括：

- (1) 各种刚度的力学弹簧
- (2) 恒力平衡附件(专利技术)
- (3) 3D移动和测力附件 (专利技术)
- (4) 高速摩擦附件
- (5) 外加电场和磁场附件
- (6) 荧光原位观察及FRAP测量(FL-SFA)附件
- (7) 电化学附件

THE SFA AND FECO OPTICAL TECHNIQUE

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