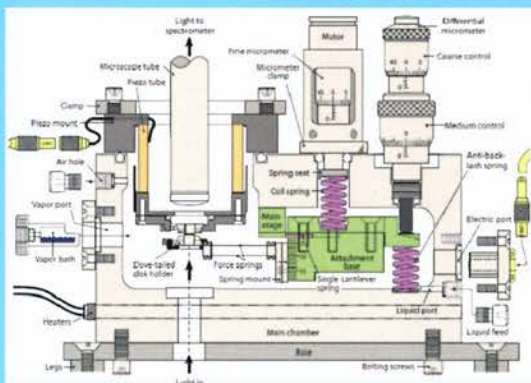
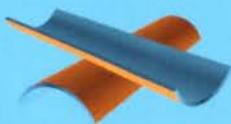


## ABOUT US

SurForce LLC was founded by Dr. Jacob Israelachvili (FRS, AAS, NAE, NAS) in 2002 and is the only supplier of the Surface Forces Apparatus (SFA 3, SFA 2000 and  $\mu$ SFA). He is the author of the text book, "Intermolecular and Surface Forces"- Elsevier/AP and is currently a Professor in the Chemical Engineering and Materials Departments at the University of California at Santa Barbara.

SurForce LLC occupies 2,140 sf of office/lab space located less than 3 miles from the UC Santa Barbara campus and Jacob's Interfacial Sciences Lab. Our lab area consists of engineering and manufacturing assembly spaces, laminar flow fume-hoods, Millipore DI water system (Type 1 class laboratory water), optical microscopes, chemical fume hood, Ag thermal evaporator and optical tables for performing SFA system-level product testing as well as to support contracted SFA measurement services.

Dr. Jacob Israelachvili



## SFA 2000 BASIC SYSTEM

**MAIN CHAMBER;** electrical feed-throughs, micrometers and encoder motors for controlling surfaces to  $1\text{\AA}$  using **Piezoelectric top mount** and **Main Translation Stage bottom mount**. Chamber heaters (2x100W) with thermistor.

15 nN sensitivity (normal and adhesion forces)  
0.1 nm ( $1\text{\AA}$ ) distance resolution  
<0.1  $\text{\AA}/\text{sec}$  to >1 mm/sec approaching speeds  
<1  $\mu\text{m}$  lateral distance resolution  
<0.1  $\text{\AA}/\text{sec}$  thermal drift  
(2 hr equilibration in a  $\pm 0.1^\circ\text{C}$  enclosure)

## POPULAR ATTACHMENTS

### PIEZOELECTRIC TOP MOUNT

1nm/V over 1 $\mu\text{m}$  range upper surface movement

### MAIN TRANSLATION STAGE BOTTOM MOUNT

Double-cantilever force springs : 30 - 500,000 N/m

### FRICTION TOP MOUNT

Actuation (+/- 2 mm range)

Shear force sensing 1-10  $\mu\text{N}$  (0.1-1 dyne)

Friction spring:  $10^{10}$  N/m ( $10^7$  dyn/cm)  
(other stiffness available).

Lateral distance sensitivity:  $\sim 10\text{\AA}$

Friction Coefficient resolution: 0.0001

Range of lateral sliding speeds: 0.05 to 5  $\mu\text{m}/\text{s}$ ,  
(other speeds available)

### BIMORPH SLIDER BOTTOM MOUNT

1D (or 2D) actuation (2 mm (20 $\mu\text{m}$ ) displacement)

Lateral sliding speeds:  $10^{-8}$  to  $\sim 4$  cm/s

Driving frequencies:  $10^{-6}$  to  $\sim 40$  Hz

Load-sensing force springs (gauging optional)

## OTHER ATTACHMENTS

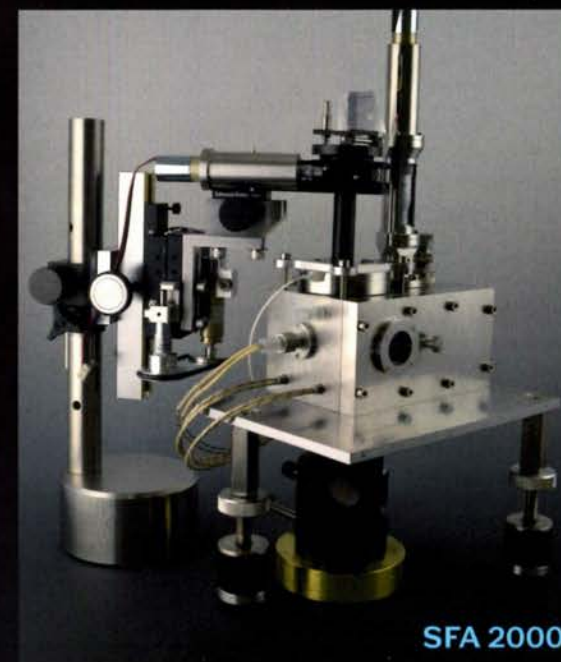
3D Sensing top mount, Variable Spring stage (10nN sensitivity), High-speed friction (rotating disk) bottom mount (8m/s), Bimorph Vibrator, electrochemical attachment (EC-SFA) and **customized or fully custom attachments!**

**CONTACT US TO DISCUSS  
YOUR MEASUREMENT NEEDS!**

SurForce LLC

354 S Fairview Avenue, Suite B  
Goleta, CA 93117-3629

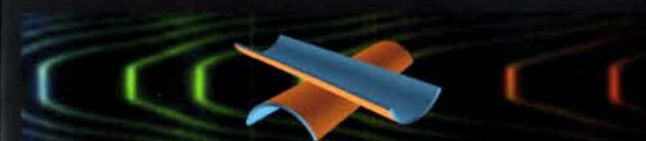
info @ SurForceLLC.com  
www.SurForceLLC.com



SFA 2000

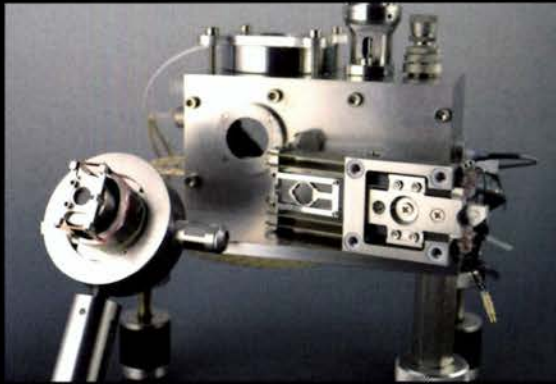
# The Surface Forces Apparatus

## SFA 2000 & $\mu$ SFA



## SurForce LLC

+1 (805) 722 - 9316



**SFA 2000**- full scale SFA (normal & shear forces)



**μSFA**- microscope-ready SFA (inverted)



**Pre-Made SFA Disks**- ready to use & re-use

## What is an SFA?

The Surface Forces Apparatus (SFA) is a sophisticated research instrument for directly measuring static and dynamic forces between surfaces (inorganic, organic, metal, oxide, polymer, glasses, biological, etc.) and for studying interfacial and thin film phenomena at the molecular level.

For anyone who wants to accurately measure the forces or any type of "interaction" between two material surfaces at any given separation in air, vapor or liquid, including their local geometry (shape) and deformations, the **SFA 2000** stands unrivalled as to directness of measurement and visualization, unambiguous (sub-ångstrom) accuracy, and stability to thermal drift. Unlike some surface force-measuring instruments, such as scanning probe microscopes and pin-on-disk tribometers, the **SFA 2000**, especially when used with FECO (Fringes of Equal Chromatic Order) optics, measures forces between surfaces at precisely known surface separations, providing the local surface geometry (shape), directly at the point of interaction.

Our new **μSFA** is a microscope-ready compact SFA which can be used for normal force studies in most upright or inverted microscopes and with short-focal length objectives. Molecularly smooth surfaces of hard materials such as mica, silica, sapphire, polymers, serve as suitable substrate surfaces in most measurements; these can also be coated with thick or thin layers of surfactants, lipids, polymers, metals, metal oxides, proteins and other biomolecules. We also now offer **Pre-Made SFA Disks** with a silica surface for improved ease-of-use (no mica cleaving/ gluing) and -functionalization (standard adsorption, deposition and reaction processes).

## Unique features of the SFA-FECO technique:

The SFA coupled with the FECO optical technique allows one to measure;

- the force,  $F$ , between two surfaces,
- the absolute separation distance,  $D$ , between two surfaces to 0.1 nm -directly, independently and unambiguously-, even when they are well-separated,
- the local shape profiles / elastically deformed geometry of the surfaces in the interaction zone, such as the local radius of curvature  $R$ ,  
to convert from force-distance function,  $F(D)$ , to the surface energy-distance function,  $E(D)$ , and adhesion/surface energy,  $\gamma = 1/2E(0)$ ,
- the exact contact area,
- the refractive index of the material (adsorbed film or trapped liquid) in the gap, allowing determination of the amount of material between the surfaces, as well as any capillary liquid bridge between (discontinuities in the refractive index),
- dynamic or non-equilibrium interactions, where an intermolecular force changes (relaxes, equilibrates, increases, decreases, etc.) with time-even if the rate of change is as slow as ångstroms per day; and can distinguish this from thermal drift or viscous forces.

The SurForce basic system and suite of optional attachments make the SFA a truly "multimodal" instrument capable of simultaneous quantitative measurements of both physical (including electrical) and chemical interactions between two surfaces close together from the macro-, through the micro-, and down to the subnano-scale, and under both static and dynamic conditions.

SurForce continually works to further extend the versatility of the SFA by introducing new surface characterization techniques via attachments that can be fitted to the SFA Basic System.