LK TECHNOLOGIES

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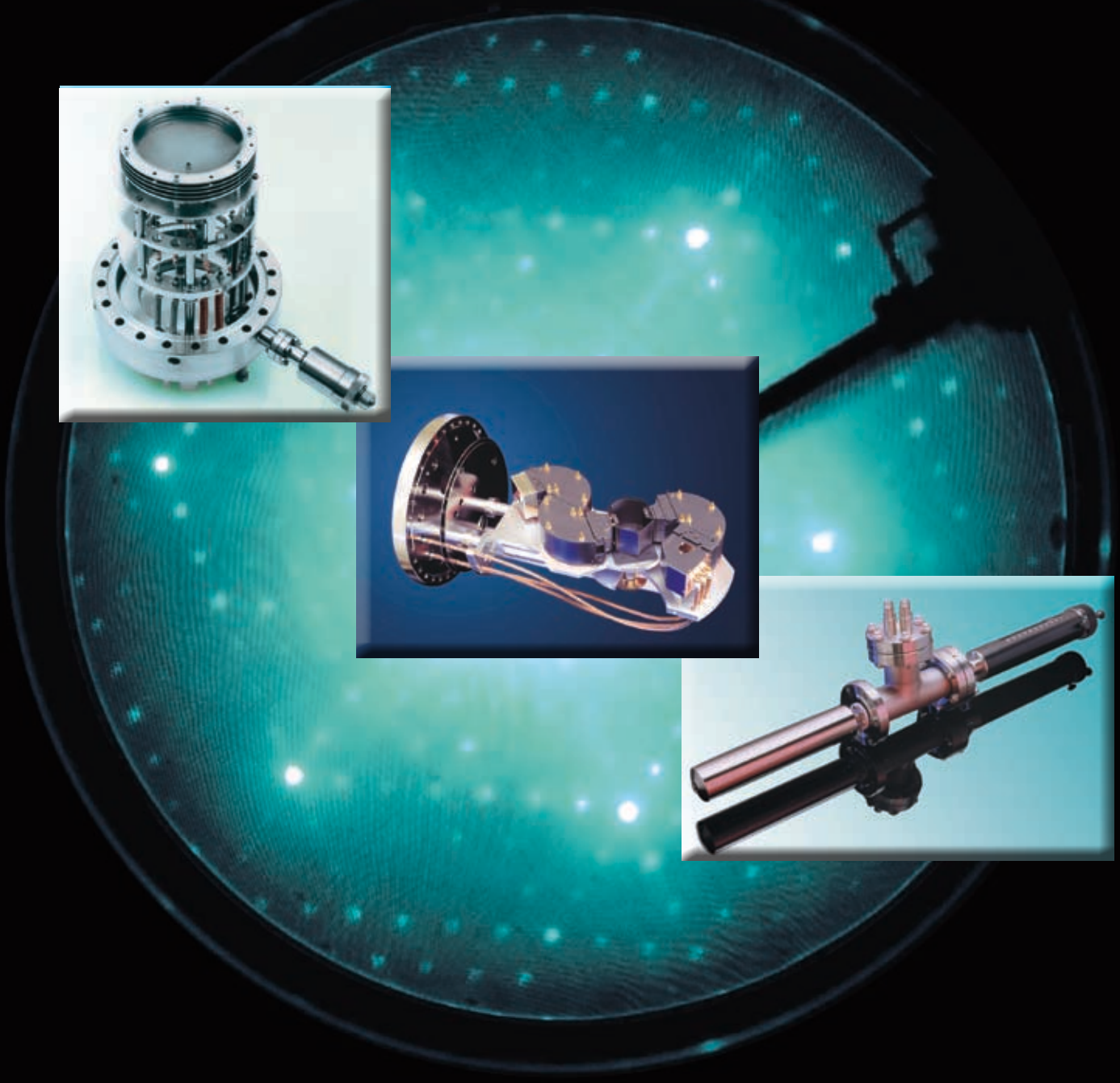
Instruments for Surface Science and Nanotechnology

LK Technologies is a leading supplier of precision equipment for surface science and nanotechnology. Our reputation is built on a history of supplying robust, high performance electron and ion-optical equipment to leading academic and industrial laboratories worldwide.

We offer a complete product line of electron energy analyzers and electron & ion sources for surface science, including high resolution (1 meV) analysis.

For structural analysis, our LEED and RHEED product line includes a variety of basic systems as well as low current MCP detectors for sensitive samples used in surface and nanoscience.

We specialize in completely integrated custom vacuum systems which incorporate these techniques and others in high and ultrahigh vacuum studies. We welcome inquiries to build custom systems to meet your specific requirements.



Electron Spectrometers: EELS, MINICMA

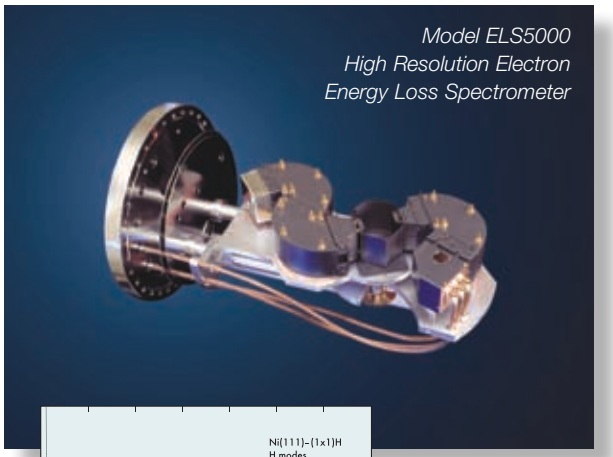
High Resolution Electron Energy Loss Spectroscopy (EELS)

High-resolution electron energy loss spectroscopy (EELS) is a powerful surface-analytical technique which provides unique vibrational analysis of metal and semi-conductor surfaces in a high-vacuum environment. Increasingly, insulators and polymer films are also being studied by means of charge-neutralization techniques. EELS readily provides important information on:

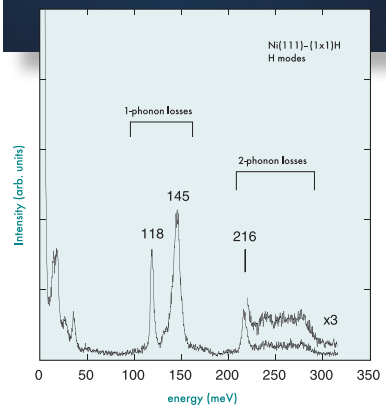
- adsorbate vibrational frequencies
- molecular structure of adsorbates (decomposition, polymerization)
- bond strengths at surfaces
- adsorption geometry—surface-bonding sites
- surface chemistry (oxide formation, reduction, intermediates, etc.)

LK Technologies is the established world leader in EELS offering a variety of systems from the state-of-art ELS5000 and ELS3000 instruments at 0.5 meV ultimate energy resolution to the versatile, economical LK2000 which features resolution down to 3 meV in several compact geometries with integral magnetic shielding. Our HREELS control systems feature exceptionally low-noise and high stability with advanced auto-tuning control software.

We also offer several products as both electron analyzers and electron sources (monochromators) in a range of energy resolutions from 0.5 to 10 meV. These can be mounted in standard configurations or adapted to the customer's geometric requirements. Please consult the company with your special application.



Model ELS5000
High Resolution Electron
Energy Loss Spectrometer



*H/Ni (111)**

**courtesy of M. Nishijima, Kyoto University*

MINICMA ™ (CMA 2000 Series) Electron Energy Analyzers

The MINICMA™ is a versatile, double-pass energy analyzer that fits tight space requirements (diam. 1.35 in. (35mm)) and offers the ability to retract 4.0 in. (100 mm) by means of a precise linear motion feedthrough.The mounting on a standard 2.75 in. (70 mm) O.D. flange or larger makes the CMA2000 a unique instrument in its field.

The instrument design is licensed from the University of Nebraska (P. Dowben and colleagues). The LK version now features improved double pass optics. An energy resolution of 0.7% -1.5% has been demonstrated by the LK version. Auger spectra are acquired in fast analog mode. Pulse counting is available for photoelectron spectroscopy.

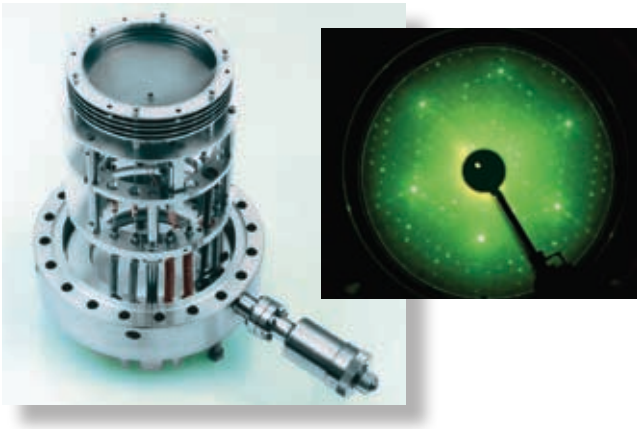
- Mounting on 2.75" (70mm) flange
- Retractable with linear motion feedthrough
- General electron energy analysis including Auger and Photoelectron spectroscopy
- Double-pass optics with energy resolution better than 1.5%

- Ideal for experiments not accessible by conventional bulky analyzers
- Combine with the RVL2000 LEED optics for a low-cost, high-performance LEED/ Auger system

Please contact LK Technologies for more information.

LEED/RHEED Instruments

Series RVL2000 Reverse View LEED Systems



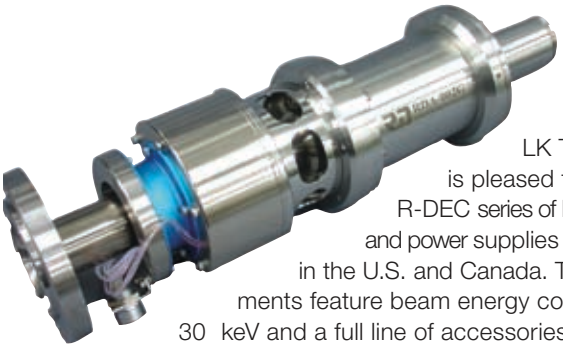
Low-energy electron diffraction (LEED) is widely employed in surface science and nanoscience to probe the surface structure of materials on an atomic scale. The hemispherical grid system employed in LEED can also conveniently serve as an analyzer for Auger Electron Spectroscopy (AES). LK Technologies offers a complete line of reverse-view LEED systems and accessories including options for AES compatibility and special low-current (MCP) models for the analysis of beam-sensitive samples.

The RVL series has seen worldwide application with a demonstrated track record for high quality LEED patterns and AES spectra. Features and options include:

- Precision 4-grid optics available in retractable and fixed geometry on both 6 in. (152 mm) and 8 in. (203 mm) CF flanges.
- Miniature electron gun to optimize LEED pattern observation
- Low-noise, high performance AES electronics with integral lock-in amplifier
- Low-current MCP models with single/dual microchannel plates for nanoampere/picoampere applications
- Accessories include integral shutters, CCD camera with shroud, image capture and analysis software

RHEED Systems

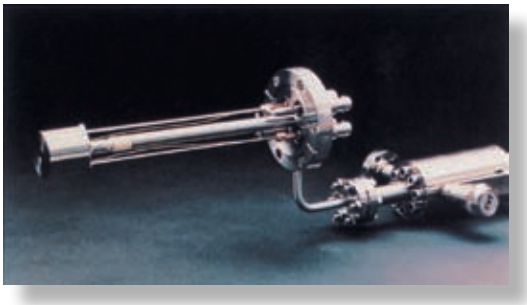
Reflection High Energy Electron Diffraction is widely used as a powerful method for real-time observation of crystal growth. RHEED can be used to analyze film surfaces in either a static mode for existing materials or dynamically as film growth evolves. It is an exceptionally valuable tool in Molecular Beam Epitaxy (MBE). A high energy electron beam (10-30 keV) is directed at the sample surface at low incident angle (1-2 °). The electrons are diffracted by the crystal structure of the sample being investigated and then projected on a fluorescent screen. The characteristic pattern of the impinging electrons is a series of streaks. The distance between streaks is an indication of the surface lattice cell size.



LK Technologies is pleased to offer the R-DEC series of RHEED guns and power supplies exclusively in the U.S. and Canada. These instruments feature beam energy control up to 30 keV and a full line of accessories including differential pumping, shielding, screens and shutters.

Excitation Sources

NGI3000 Series Ion Guns



The LK Technologies Model NGI3000 Ion Gun with control electronics is designed for the cleaning of surfaces by ion sputtering with beam energies up to 3 keV. The gun employs a patented gas injection system which allows sputtering to take place at a typical chamber pressure of 1 x 10^{-6} Torr.

This reduction in gas load represents a major advantage over conventional ion guns which require chamber backfilling to nominally 5 x 10^{-5} Torr and, therefore, involve longer pumpdown times and potential gas impurity problems. The gas injection system allows the NGI3000 to be employed for ISS and other ion spectroscopic applications without the need for expensive differential pumping equipment. In the standard configuration a broad ion beam is presented to the sample, thereby ensuring uniform sputtering required in most sample cleaning operations. An optional focus lens to concentrate the ion beam is available.

- patented gas injection system avoids expensive differential pumping equipment
- noble gas sputtering at low chamber pressures (~10^{-6} Torr)
- broad ion beam ensures uniform sputtering
- compatible with general sputter cleaning and ISS applications
- continuously tunable beam voltage to 3 kV

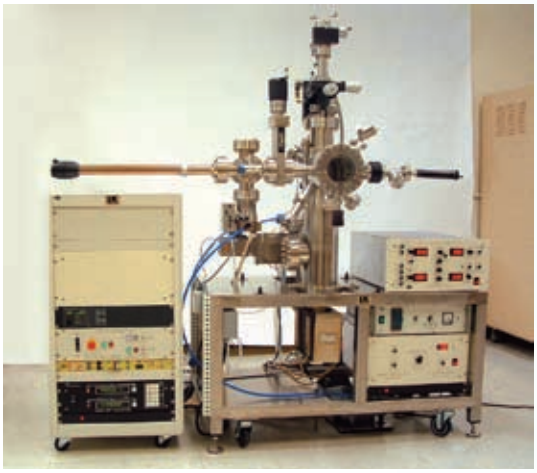
Excitation Sources (continued)

EG3000 Series Electron Guns

The LK Technologies Model EG3000 Electron Gun with matching control electronics is suitable for a variety of surface analysis applications such as Auger electron spectroscopy, electron scattering and diffraction experiments, and charge neutralization. The electron beam energy can be continuously varied from 0.05-3 keV. The beam current is adjustable to greater than 100 µA. With the standard refractory metal cathode, the gun provides a minimum spot size of approximately 1 mm at a working distance of 75 mm. The control electronics features an "autofocus" mode which maintains minimum spot size focus with beam energy variation as well as a "defocus" mode which allows operator adjustment to uniformly defocus electron beams up to 10 mm in diameter (or greater, depending on working distance).

The electron gun is fully UHV compatible, employs integral magnetic shielding and can be baked to 200°C. All electron guns are tested under UHV conditions prior to shipment. For special applications involving smaller spot sizes, high current variations or other custom requirements, please consult LK Technologies.

- operation from 50-3000 eV
- compatible with AES, charge neutralization and other surface analysis applications
- auto focus mode for small spot applications
- defocus mode for broad beam applications
- high current option available
- fully UHV compatible and bakeable



Ultrahigh Vacuum Systems

LK Technologies specializes in the design and construction of complete UHV systems which often combine several surface analysis methods from LK components as well as other manufacturers. Complete systems are available for LEED, RHEED, AES, XPS and HREELS as well as Thermal Desorption Spectroscopy (TDS). LK has experience integrating these with other techniques such as scanning probe microscopy (SPM), for example.

Common elements of these systems are precision UHV chambers, a main pump (usually ion pump), an auxiliary pump (usually turbomolecular), a precision sample manipulator, a mounting framework with leveling feet and vacuum gauging. Optional components typically requested by the customer are a rapid sample introduction system (load lock) and bakeout control. Please contact LK for more information and to discuss your custom system requirements.

Special Products and Systems

LK Technologies offers a number of special energy analyzers, electron sources and systems and can tailor a system to the customer's requirements. Examples include low and high energy resolution electron sources in a variety of geometries, hemispherical analyzer systems for UPS and XPS, miniature electron guns and custom evaporation systems. Please contact the company to discuss your requirements.

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Contact your regional representative: