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CÜNAM

**SIVAS CUMHURİYET
UNIVERSITY**

**NANOPHOTONICS
APPLICATION AND
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AIXTRON 200/4 RF-S Metalorganic Vapor Phase Epitaxy (MOVPE)

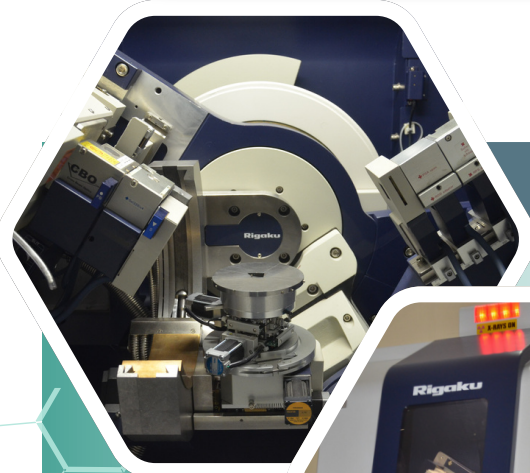
The Metalorganic Vapor Phase Epitaxy (MOVPE) technique is a method for the epitaxial growth of thin films from metalorganic precursors and hydrides, compounds of Group V elements and hydrogen (such as AsH_3 , NH_3 , PH_3 , etc.), in the vapor phase onto a solid substrate. This technique enables the growth of complex multilayer epitaxial structures with precise control over both layer thickness and composition.

Nanovac (NVT5-500-2TH1DC1RF) Sputter/Thermal Thin Film Coating

The Nanovac Sputter/Thermal combined device is a versatile high-vacuum deposition system used in materials science and nanotechnology for depositing thin films or coatings onto substrates. The system is equipped with one RF sputtering source, one DC sputtering source, and two thermal evaporation sources. RF/DC sputtering involves bombarding a target material with high-energy ions to eject atoms or molecules, which then deposit onto the substrate. In the thermal evaporation method, materials are vaporized by heating and subsequently condensed on the substrate, enabling precise and controlled material deposition.



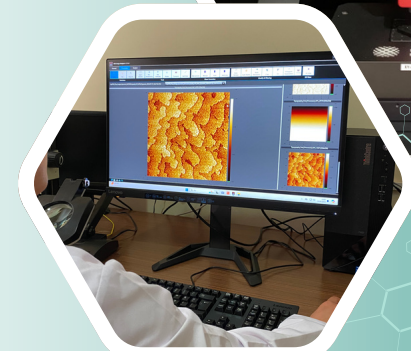
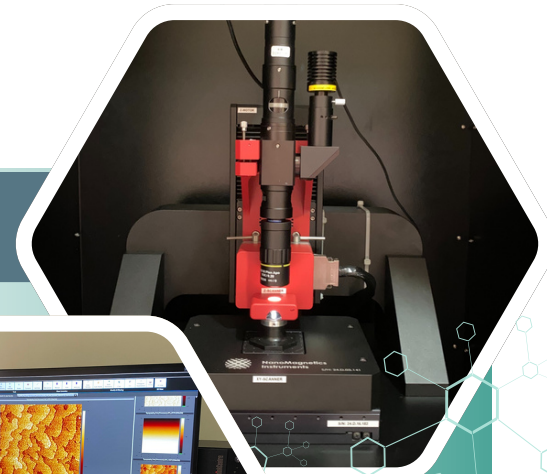
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**Rigaku SmartLab High Resolution X-Ray Diffraction (HRXRD)**

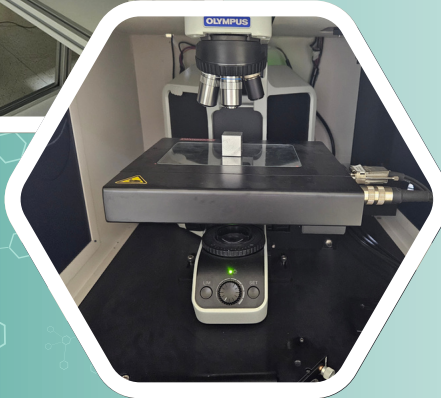
The X-ray diffraction (XRD) technique is one of the most fundamental methods used to determine the structural characteristics and quality of semiconductor thin films. It is employed to analyze alloy compositions and lattice constants in ternary alloys, and it is non-destructive to the material. This technique provides critical information about the material's chemical composition, layer orientation, epitaxial layer thickness, interlayer transitions, internal stresses, and dislocations.

High Performance Atomic Force Microscope (hp AFM)

Atomic Force Microscopy (AFM) is a high-resolution imaging technique that enables researchers to examine surfaces at the nanoscale. AFM can operate in various modes, including contact and non-contact, depending on the interaction between the probe tip and the sample surface. Data obtained from AFM can be used to generate topographical maps of the surface, allowing for precise measurement of surface roughness, texture, and other nanoscale surface properties.



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**Broad Spectrum (200 - 2200 nm) High Resolution Photoluminescence Spectrometer System**

- **Photoluminescence (PL):** This technique is based on the principle that when a material is excited with light of a specific wavelength, it absorbs the energy and transitions to a higher energy state. As the material returns to its ground state, it emits photons, which are collected and analyzed. The wavelength and intensity of the emitted photons reveal key characteristics of the material, such as bandgap energy and defect states.
- **Raman Spectroscopy:** In this technique, laser light incident on a sample interacts with its molecules, causing a small fraction of the photons to scatter at different wavelengths due to vibrational and rotational transitions. Raman spectroscopy provides detailed information about chemical bond types and structures, bond lengths and angles, molecular vibrations and rotations, phase states, stress and strain within the sample, and the effects of environmental conditions such as temperature and pressure.

Kulicke and Soffa Model 4124 Ball Wire Bonder

Gold ball wire bonding is used to create conductive interconnections between an integrated circuit (IC) chip and external leads or other components. This technique enables the application of electrical power to the device and allows signal transmission to and from the device structure.



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**Nikon Eclipse LV150N Optical Microscope**

The LV150N is a versatile industrial microscope that supports a wide range of observation methods and optical contrast techniques. Designed for high-precision analysis and optimized for advanced imaging applications, it offers high sensitivity in detecting surface height variations and defects. It is also capable of visualizing colorless and transparent samples using contrast-enhancing methods such as diffraction and interference.

Nomarski Mode Material Microscope

The Axiolab 5 Microscope is a high-performance laboratory microscope designed for applications in biology, materials science, microscopic analysis, and digital imaging. Equipped with advanced optical systems and integrated digital features, it enhances the precision and accuracy of observations across a wide range of fields, from biological and medical research to industrial quality control and educational use.

Motic PMS-1000 Microscope

It is a modular microscope system designed for applications in the semiconductor industry. Featuring a three-lens configuration, it enables seamless switching to laser-based operations during use, providing flexibility and precision for advanced inspection and analysis tasks.

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**Hall Effect Measurement System (HEMS)**

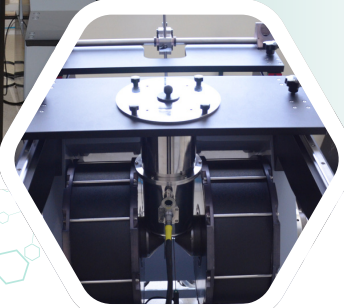
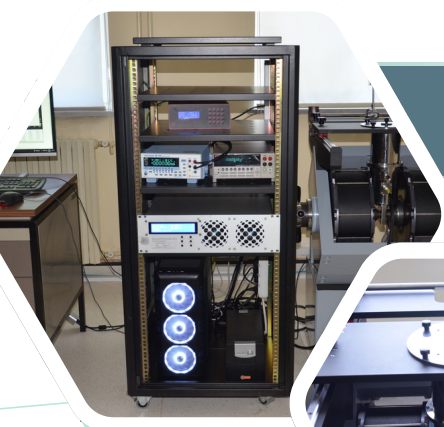
The Hall technique encompasses various measurements including Hall mobility, Hall voltage, current-voltage (I-V) characteristics, resistance, magnetoresistance, carrier concentration, and four- and six-point contact resistance measurements. These measurements are based on the interaction between the electric current passing through a material and the magnetic field applied to it. The system is capable of operating at room temperature as well as in the temperature range of 80–300 K.

Electrochemical Capacitance-Voltage (ECV) System

Electrochemical Capacitance-Voltage (ECV) measurement is a technique used to determine the doping profiles of semiconductor materials. This method detects the distribution of dopant concentration as a function of depth, starting from the surface of the material. By monitoring capacitance changes in response to applied voltage, it provides detailed information about the internal structure and electrical properties of the sample.

Keithley 4200-SCS Semiconductor Characterization System

It is a system used to take measurements such as DC I-V, C-V and pulse characterization of semiconductor structures and devices.



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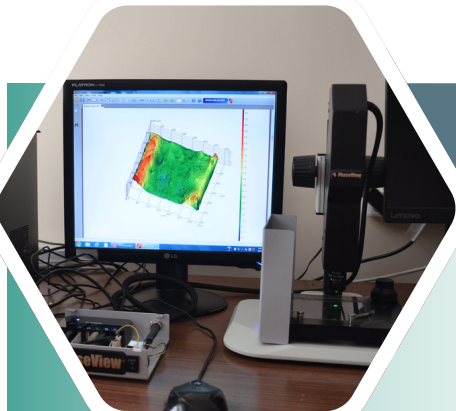
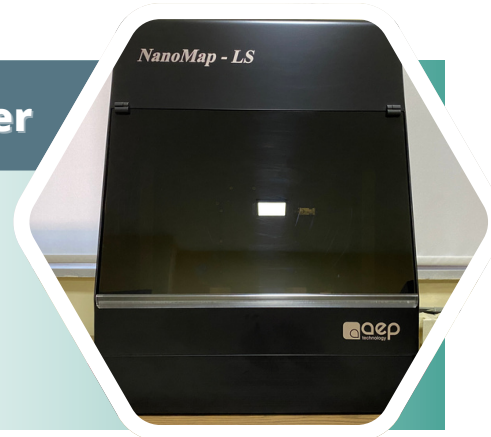


Varian UV-VIS-NIR Spectrophotometer

The Varian UV-VIS-NIR spectrophotometer system is an optical characterization tool capable of measuring the reflection, transmittance, and absorption spectra of both solid and liquid samples. From the obtained spectra, key parameters such as material thickness, band gap, absorption coefficient, and refractive index can be accurately determined.

NanoMap 500LS 3D Profilometer

The Nanomap LS 500 Contact Profilometer is a precision instrument designed to analyze the surface topography of materials at the microscopic scale. It is utilized to measure conventional surface characteristics such as surface roughness, step height, curvature, and shape across various material types and sizes.



ZeeScope Optical Profilometer

The optical profilometer can perform 2D and 3D measurements from a single point, a line, or an area. It provides detailed information on surface morphology, step heights, surface roughness, and other topographic features. A total of 12 analysis parameters are available, including commonly used metrics such as Ra (Sa), Rq (Sq), and Rz (Sz).



OPT-S9000 Spectroscopic Ellipsometer

Ellipsometry is a measurement technique that quantifies the change in polarization of light upon reflection from a material. Spectroscopic ellipsometry provides detailed information about the optical properties of the sample by analyzing how the polarization state of incident polarized light is altered. This technique is widely used for thin film characterization due to its non-destructive nature and high sensitivity. Additionally, a temperature-dependent measurement setup is available, allowing investigation of the effects of temperature variations on the optical properties of the sample.

Unitemp-100 RTP (Rapid Thermal Processing) System

The UNITEMP RTP-100 Rapid Heat Treatment System is an annealing device used for various applications, including enhancing the mechanical properties of metals, semiconductor crystallization, and defect elimination. This system enables rapid heating of materials to high temperatures in a vacuum or controlled gas environment. After the process, materials can be cooled slowly and in a controlled manner.



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**HOGEN S40 S-Series Hydrogen Generator**

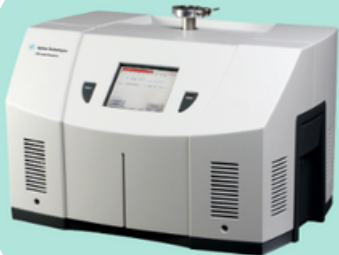
A hydrogen generator is a device that produces hydrogen from water through a process called electrolysis. The HOGEN S Series hydrogen production systems can generate up to 1.05 Nm³/s (40 scf/s) of ultra-high purity hydrogen gas for applications such as materials processing, power plant generator cooling, and electronics or semiconductor manufacturing.

Deluxe Power Meter

The Deluxe Power Meter (Luxmeter) is a power and energy measuring instrument specifically designed for use with thermopiles and optical detectors. The versatile pyroelectric energy detectors with broadband coverage are optimized for measuring low to high power densities. This instrument is often used in laboratories or industrial environments to determine important parameters such as optical power, power loss, power and energy density in optical systems.

**VS Series Helium Mass Spectrometer Leak Detector**

The VS Series Helium Mass Spectrometer Leak Detector is an advanced device that detects leaks using helium gas. Helium is inert, non-toxic and has a small atomic size, allowing it to safely leak even the smallest leaks. The leak detector separates the helium in the tested medium and allows leak detection with high sensitivity by measuring the amount of helium drawn with the mass spectrometer inside. These features make the device ideal for the aerospace, automotive and semiconductor industries.





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