LAwave®
Non-Destructive Analysis for Nanocoatings

NON-DESTRUCTIVE TESTING OF ULTRA THIN FILMS

LAwave® is a non-destructive measurement system that analyzes the material’s stiffness and density with incredible accuracy even for ultra thin films. LAwave® is the only measuring device that is sensitive to films less than 5 nm. It is a fast, non-destructive and highly accurate quality control tool.

BACKGROUND

Protective nanocoatings on applications such as hard disks, industrial tools, components and materials for semiconductor manufacturing must meet increasing requirements.

Mechanical testing of thin film coatings becomes exponentially more difficult with decreasing film thickness.

When the thickness decreases below 200 nanometers conventional techniques such as mechanical indentation are unable to deliver precise results due to substrate effects. Fraunhofer developed the LAwave® to overcome these issues.

FEATURES

Non-destructive measurement
Sensitive to films < 5 nm up to mm
Multilayer analysis capability
Fast measurement cycle (< 5 min)

FILM MATERIALS

Diamond-like carbon, diamond
Nitrides, carbides, oxides, ceramics
Polymers
Metals – steel, brass, Al, Ti, Mg
GaAs, Si, other semiconductors

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Performing the measurement is simple. The sample itself can be placed into the LAwave® machine. The substrate can be made of virtually any material as long as it allows propagation of a sound wave.

APPLICATIONS
LAwave® can benefit a wide range of process development and quality control applications. Examples include:

- Measuring the Young’s modulus of ultra-thin films < 5 nm  
  Example: diamond-like carbon films on storage media
- Defect density analysis of highly polished surfaces  
  Example: GaAs or Si wafers for semiconductor manufacturing
- Monitoring the quality of hard-metal surfaces and wear resistant coatings on machining tools  
  Example: TiN coatings on WC tools
- Monitoring the quality of thin film coatings on components  
  Example: engine components surface treated for sliding and rolling contact performance
- Analyzing the porosity of thermal spray coatings
- Quality control of heat treated surfaces  
  Example: hardened steels

HOW IT WORKS
The LAwave® tool introduces a sound wave to the sample surface and measures its propagation along the surface near region. The sound wave’s phase velocity dispersion is analyzed, which depends on substrate and film materials. A mathematical algorithm determines the Young’s modulus, thickness or density of the film. The technique is sensitive to porosity, cracks and interfacial failures. A measurement can be taken within minutes and the samples remain intact.

WHO SHOULD USE LAwave®
Anyone requiring accurate and non-destructive analysis of ultra thin film properties, LAwave® is an invaluable measurement tool.

The benefits of using LAwave® were quickly recognized at IBM. Dr Ho-Cheol Kim at IBM Almaden Research Center has been using the LAwave® machine for just under a year. He says: "We use LAwave® to measure the mechanical properties of our nanoporous ultra low dielectric constant materials. We find it provides us very reliable results.”

The LAwave® system also received the prestigious R&D 100 award in 2001.

HOW TO ACQUIRE LAwave®
To purchase a LAwave® system, simply contact Fraunhofer at 517-432-8173 to discuss your requirements.

LAwave® testing services are also available.