Thin Film Materials Characterization Services

NANO3D provides physico-chemical characterization services of the metal foils and films deposited on different substrates.

Thermal Properties:

- **Specific heat capacity**

Differential Scanning Calorimetry (SDT Q600) analyzes specific heat capacity over the temperature range from ambient to 1500 ^{0}C.

- **Linear thermal expansion**

Testing linear thermal expansion of the metal alloys using technique based on bending of bonded layers due to the thermal stress.

- **Thermal conductivity**

Testing the planar thermal conductivity of the thin films (down to 5 μm).

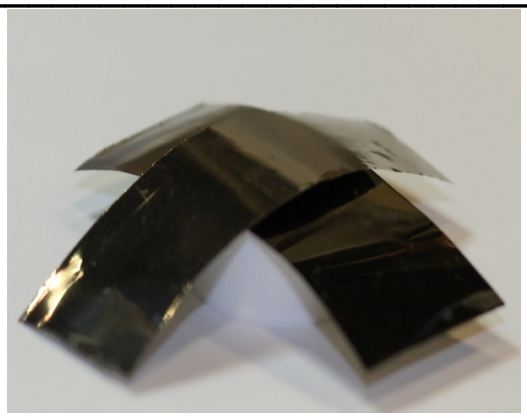
Mechanical Properties:

- **Internal stress and adhesion**

The internal stress has been studied using the bent strip technique. Stud pull testing is used to measure the adhesion.

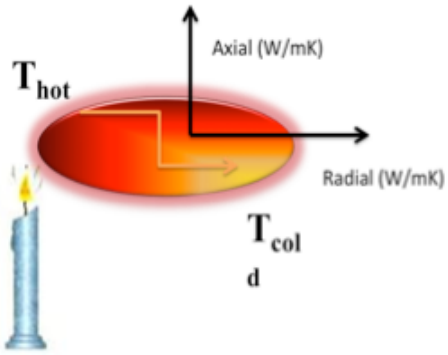
- **Elastic and plastic characteristics**

The tension test utilizing Instron technique evaluates Young's modulus, yield strength, tensile strength and ductility of the thin films.

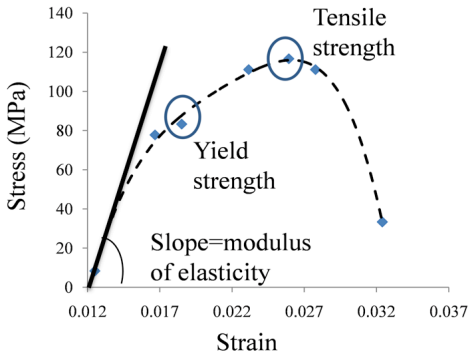


Controlled expansion alloy films for shadow masks, bimetallic actuators

Linear thermal expansion



Planar (radial) thermal conductivity



Mechanical properties of metal foils

Thin Film Materials Characterization Services

Surface morphology:

• Thickness, uniformity, roughness

The surface roughness of the films controlled by optical profilometer and Atomic Force Microscopy (AFM) for areas which vary from several nanometers up to 500 μm.

Alloy composition:

• Metal alloy composition

The composition of the alloy by weight percentage is studied via UV-VIS spectroscopy.

• Elemental composition

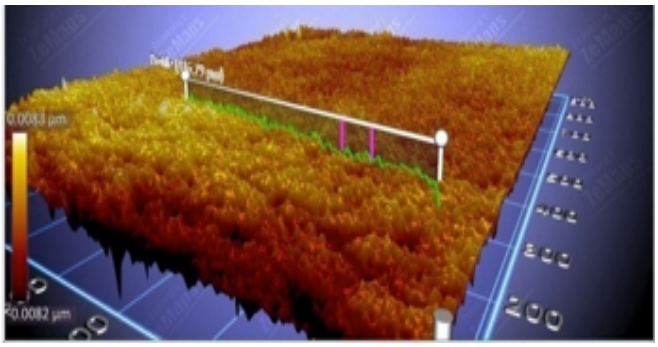
The elemental composition of the surface of the films is measured by Scanning Electron Microscopy coupled with Energy Dispersive X-ray Spectroscopy (SEM/EDX). The resolution of the SEM is 3 - 5 nm, and the spectral resolution of EDX is 2%.

Thin film cross-sections are prepared by Focus Ion Beam (FIB) and analyzed by Transmission Electron Microscopy (TEM). Accelerating voltages range from 20-120 kV, providing a point resolution of 2.7 Å. Electron diffraction patterns can be obtained from the crystals as small as 1 nm.

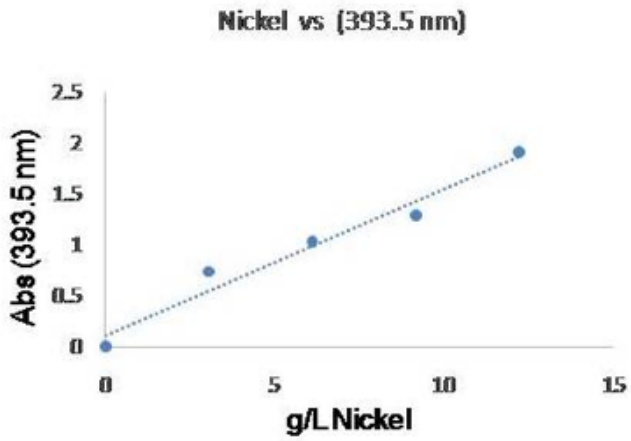
• Impurities

Quantitative secondary ion mass spectroscopy (SIMS) analysis evaluates the distribution of impurities in metal films and dopants in semiconductors. It provides elemental depth profiles over depth ranges from a few angstroms (Å) to tens of microns.

Time-Of-Flight SIMS allows measurements of very low concentrations of impurities & dopants with detection limit of 1 x 10^{16} atoms/cc and can be readily quantified to within ±20% of that ultra-low concentration.



Surface morphology of the metal foils by optical profilometer



Calibration curve of the dissolved nickel based on the UV-visible spectra

CONTACT INFORMATION:
1110 NE Circle Blvd, ATAMI/Bldg.11,
Corvallis, Oregon, 97330-4254, USA
Phone: (503) 927 - 4766
Fax: (541) 758 - 9320
https://www.nano3dsystems.com