

# Spectroscopy Performance Note

## Understanding the Glow Discharge Source

### The Sputtering Process

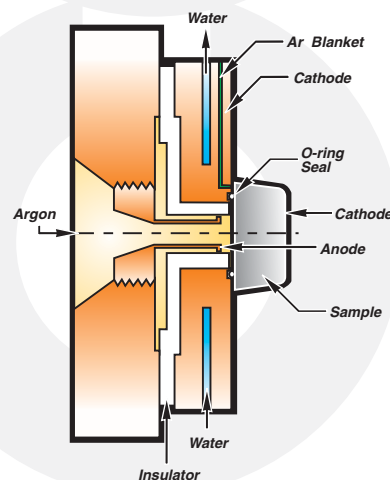
- The Glow Discharge Spectrometer (GDS) lamp provides a low pressure argon environment (typically 5-10 Torr) over the sample surface.
- A high negative potential (typically -800 to -1200V) is applied to the sample. The sample thus becomes the cathode.
- Spontaneously produced Argon ions ( $\text{Ar}^+$ ) are accelerated across the anode/cathode gap by this potential.
- The collision of  $\text{Ar}^+$  ions with argon gas molecules causes plasma formation and further production of  $\text{Ar}^+$  ions. This plasma is called a glow discharge.
- Some of these high velocity  $\text{Ar}^+$  ions reach the sample surface where they sputter (or mill out) materials uniformly from the sample substrate.
- Some of this sputtered material diffuses into the glow discharge plasma where it is dissociated into atomic particles and finally excited.
- The light emitted from these excited state species as they collapse back to a lower energy level is characteristic of the elements composing the sample.
- The wavelengths and intensity of the light emission are used to identify and quantify the composition of the sample.

### GDS Advantages

- Layer-by-layer removal of material allows for qualitative and quantitative depth profile analysis
- Separation of sampling (sputtering) and excitation resulting in:
  - Freedom from metallurgical history
  - Fewer matrix effects
- Grimm-type Lamp design provides lowered self-absorption and material re-deposition
- Linear calibration curves with wide dynamic range
- Fewer lines required to analyze full concentration range
- Linear calibrations require fewer standards for calibration
- Fewer spectral interferences due to:
  - Narrow emission lines
  - Excitation of almost exclusively atom lines
- Very little sample-to-sample carry-over allows quick matrix changes
  - Automatic cleaning between samples
  - No sputtering of anode or other lamp components
- Low reference material consumption
  - More burns before required resurfacing
  - Shallower burn spots requiring less material removal during resurfacing
- Low gas and other consumable consumption
- Very easy to operate
- Quiet, clean, and low maintenance
- Small footprint—fits through standard lab door



GDS500A



GDS Source



GDS Lamp



Delivering the Right Results

Form No. 209-076-035

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