

*Abstract*

There is a need for rapid, high-resolution (micron or sub-micron) scanning of surfaces of special nuclear materials (SNM) and surrogate materials to locate and identify regions of abnormalities. One technique that is commonly used to analyze the composition of solid surfaces and thin films is secondary-ion mass spectrometry (SIMS). SIMS devices are very complex and expensive. We propose to develop a simpler, less expensive surface analysis devices, based on glow-discharge optical emission spectroscopy (GOES) that can provide excellent spatial resolution. Ions from a plasma discharge sputtered atoms from the surface and the discharge electrons effectively excite and ionize the sputtered atoms. GOES uses the light emitted by the excited particles for quantitative analysis. In the GOES device, the ion flux is extracted from the gas-discharge plasma and focused to a micron size on the sample, providing very local sputtering and local elemental analysis. The radiation from the sputtered atoms is passed through an optical fiber to an optical spectrometer and recorded. To register the distribution of elements over the sample, the sample is scanned electro-mechanically. as a polarized deuteron injector for a future EIC.

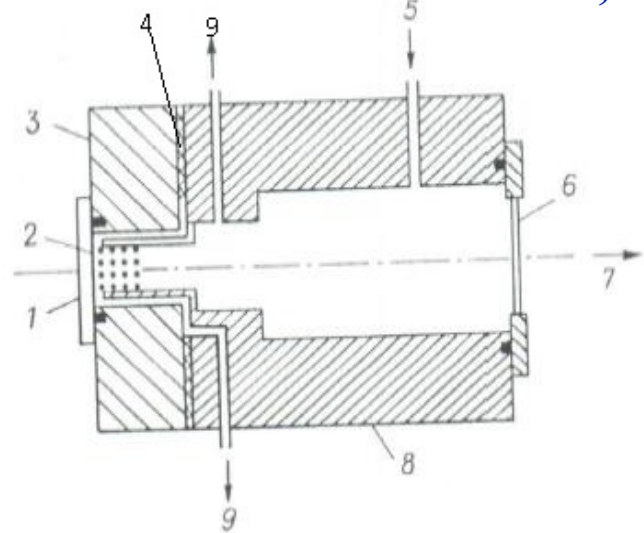


Fig. 1. Grimm lamp for OGDS. UPPER: 1- sample; 2- discharge; 3- cathode; 4- insulator; 5- gas supply; 6- quartz window; 7 - monochromator and detector; 8- anode; 9- pumping.

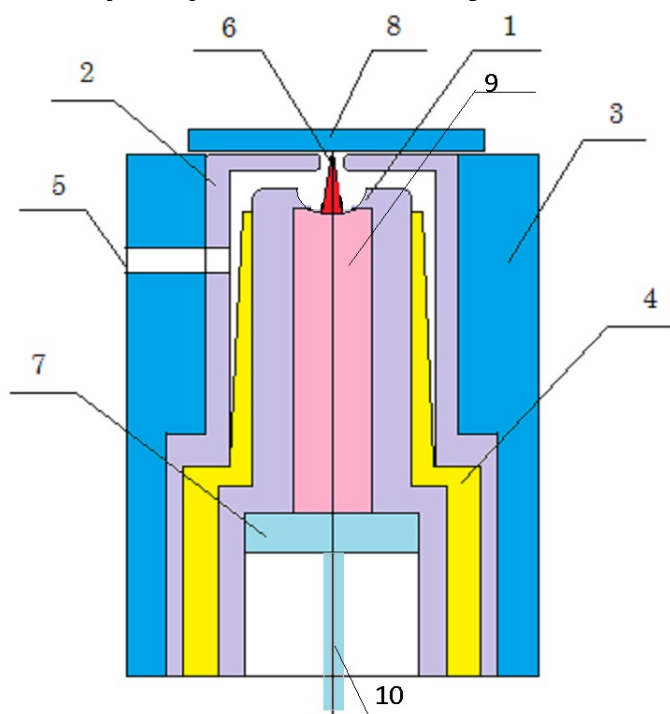


Fig. 3. The scheme of the discharge device with self-focusing ion beam. 1- anode; 2- cathode; 3- case; 4- insulator; 5- gas supply; 6- focused ion beam; 7- window; 8- sample, 9- discharge plasma, 10- fibreglas optic.

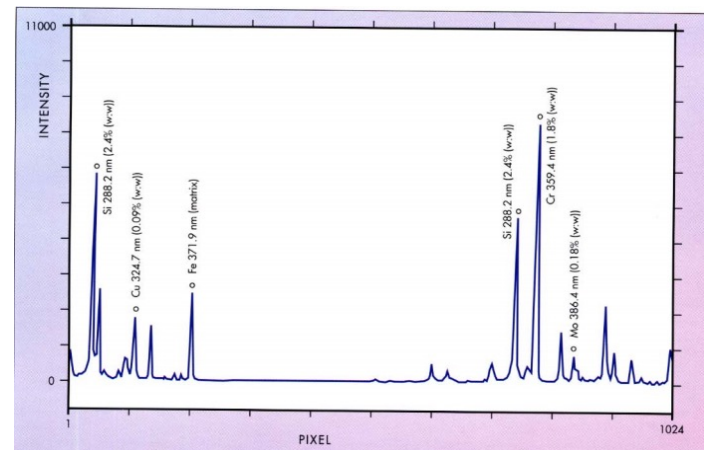


Fig. 2: An example of a spectrally segmented emission spectrum of glow discharge using a Grimm-type glow discharge lamp with floating restrictor (8-mm diameter): 50 mA, 3.5 Torr, 2 kV; 22 Plasma array spectrometer (LECO); steel sample: 217A (Research Institute, CKD, Prague)

Fig. 4: Computer simulation of fine focused ion beam formation.

