

Pulsed LIBS Ablation System with Static High Resolution Quadrupole for ^3He Determination

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The analysis of ^3He from tritium decay in metal surfaces exposed to large amounts of tritium gas is used to study material lifetime of potential fusion reactor components. To minimize the amount of exposure and facilitate sample handling, the analysis system needs to be designed to handle small samples with extremely high sensitivity. Savannah River National Laboratory is currently assembling a new static mass spectrometer based on a combination LIBS/Laser Ablation system interfaced to an ultrahigh static vacuum system. The vacuum system uses a combination of a gated turbo pump system with isolated ion getters and direct ionization pumps. The vacuum chamber is directly interfaced to a high resolution Extrel MAX60 quadrupole which is optimized for the separation of ^3He from HD. The quadrupole has a high gain SEM detection module for ppb level sensitivity in micrograms of ablated sample. The getter is designed to trap residual tritium and other hydrogen components that might be present. The sample is mounted on a small bellows sealed positioning stage that may be raster across the laser. The laser is a Quantel Brilliant EaZy NdYAG set for 1064 nm operation and focused to about a 50 micron ablation spot size. Harmonic doublers may be used to work at lower wavelengths and sharper spots. The beam is focused through a quartz or sapphire window and may be adjusted due to the use of infinity correction optics and standoff 100 mm objective in the beam design. A splitting hot mirror allows the focal point to be monitored using a CCD camera. The beam is maintained in a closed system.