

Characterisation of Silicon Nitride and Aluminium Window SDD Under Low Pressure Environments

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Silicon Drift Detectors (SDDs) are integral to X-Ray Fluorescence (XRF) spectrometry. They are vital for non-destructively analyzing cultural heritage samples. Traditionally, these detectors have used beryllium windows to maintain vacuum and protect the sensor. However, beryllium windows are not transparent to low energy X-rays. This opacity restricts the ability of SDDs to measure oxygen's characteristic X-rays. Recent advancements in SDD windowing technology have led to the development of detectors featuring silicon nitride and aluminum windows. This change enhances the low energy X-ray detection capabilities of SDDs, enabling the detection of lighter elements.

However, this new type of window is not helium tight. In previous XRF studies, helium is often used to displace air, allowing for increased flux of X-rays to the sensor. Since this is not possible with the new windows, it inspired us to take XRF measurements in various low-pressure environments to study the improvement of the detection sensitivity, particularly for low energy X-rays. We performed characterization studies of these new SDDs in different vacuums, highlighting their performance in capturing low energy X-rays and comparing these results to previous SDDs.

The heightened sensitivity from the silicon nitride and aluminum window in different vacuum systems increases the potential information that can be derived from non-destructive XRF analysis. This can improve the identification and preservation of historical materials. The potential applications of this technology also extend beyond the field of cultural heritage into space exploration. The improved detection of low energy X-rays could be instrumental in deciphering the composition and geological history of astronomical surfaces, especially as the detection of oxygen can be used as a marker for water. This advancement in SDD technology, therefore, not only enhances our ability to understand the past on Earth but also opens new frontiers in space exploration.

Collaboration

Role of Submitter

I am the presenter

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