Contribution ID: **126** Type: **poster**

Performance Evaluation of New Generation CdZnTe Detectors for Safeguards Applications

Wednesday, 22 October 2014 14:50 (40 minutes)

Cadmium zinc telluride detectors (CdZnTe) have found a wide application in non-destructive assay measurements in the IAEA's verification practice. It is because of their form factor, usability, sensitivity and good spectral characteristics that they are extensively used for fresh and spent fuel attribute test measurements. Until now, the series of CdZnTe detectors utilized in the IAEA have covered the range of 5 mm3, 20 mm3, 60 mm3 and 500 mm3 of sensitive volume. Recently, new CdZnTe detectors with improved spectroscopic characteristics and significantly bigger active volume have become available, owing to advances in crystal and detector manufacturing and signal processing technologies. The distinctive feature of this new technological development is the application of a low-intensity monochromatic optical stimulation with infrared (IR) light. The use of IR illumination with a properly chosen wavelength close to the absorption edge of the CdZnTe can significantly improve the performance of the detectors. Recognizing potential benefits of these detectors in safeguards applications, the IAEA has performed an evaluation of their performance characteristics. Under evaluation were several new detectors with sensitive volumes of 500 mm3, 1500 mm3 and 4000 mm3, as well as all-in-one 60 mm3, 500 mm3 and 1500 mm3 integrated micro-spectrometers available from RITEC, Latvia. In addition to the standard performance characteristics, such as energy resolution, peak shape, efficiency, linearity, throughput and temperature stability, the potential use of the detectors for safeguards specific measurements, such as uranium enrichment with infinite thickness method, was of particular interest. The paper will describe the advances in the CdZnTe detector technology and present the results of their performance evaluation.

Country or International Organization

Latvia

EPR Number (required for all IAEA-SG staff)

758

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Session Classification: Challenges in Spent Fuel Verification: E-Posters