Contribution ID : **101** Type : **Poster**

A low-energy set-up for gamma-ray spectrometry of NORM tailored to the needs of a secondary smelting facility

Friday, 30 September 2016 15:06 (0:02)

Content

In the context of striving for a sustainable society, residues are increasingly used as input-material for certain industries. Many metals can for example be extracted and recycled in this way. In the frame of the European project "MetroNORM" (Metrology for processing materials with high natural radioactivity) several European NMIs (National Metrological Institutes) have worked together to develop new radiological methods adopted for measuring NORM (Naturally Occurring Radioactive Materials) and to produce reference materials suitable for testing these new methods. One work package in this projects deals with in-situ measurements at industries. Five companies in different industrial branches were selected and specially designed measurement stations were developed and installed on-site. This paper deals with a gamma-ray spectrometry measurement station developed for a secondary smelter for metal production using input from industries with NORM as indicated in Annex VI of the Euratom Basic safety standards (EU-BSS, Council Directive 2013/59/EURATOM). The main radiological interest for the MetroNORM part for this project is the study of 210Pb and 210Po but all the primordial radionuclides that can be detected using gamma-ray spectrometry should be monitored. The set-up and the associated software were designed in such a way as to enable adequate and relatively rapid monitoring of incoming material (mainly slag) and final products. The main aim was to check that incoming material was below clearance levels, which required relatively short measurement time for 210Pb but long measurement time for 210Po. It was, however, also important to quantify all gamma-ray emitting natural radionuclides as well as lower activity levels to better understand the processes involved in the production and to link activity in the output to the input and process. This will eventually be used to better control and steer processes in a more efficient way. The measurement station was based on a low-background point-contact HPGe-detector with a sub-micrometre top deadlayer (a Canberra BEGe detector, BE2825). It was installed in a low-background lead/copper shield inside the chemistry laboratory of the company. A special feature of the set-up was that the signal was split in two parts so that two spectra were collected using two chains of digital electronics. One chain had high amplification to obtain sufficient number of channels in the low-energy peaks and the other chain had low amplification to be suitable for the high energy peaks. The sample preparation for slag involved crushing, sieving and usage of plastic sample containers of 186 mL. The sample from the final product was a cylindrical slab of metal that was just rinsed on the outside with iso-propanol. The main aim was simultaneous determination of 210Pb using the 46.5 keV gamma-ray and 210Po using the very weak 803 keV transition, which was also possible but only in the samples of the final products as they were depleted in 40K and the Th and U decay chains. To reach a detection limit of 5 Bq/g, the standard measurement time was 15 minutes but detection of 210Po required a 12 hour measurement due to the extremely low emission probability of the 803 keV line (0.00123%). An important step for obtaining low-detection limits for given radionuclides was during sieving as different radionuclides accumulated in different parts (size-fractions) of certain slag materials. The paper will describe the measurement set-up and the main steps in the measurement sequence to obtain low detection limits for the most important radionuclides.

About the Presenter

Mikael Hult has been the ICRM-LLRMT WG coordinator since 2012. He is specialised in underground gamma-ray spectrometry and has led the collaboration CELLAR (Collaboration of European Low-level underground Laboratories). He is the author of more than 100 scientific articles in the field

of applied nuclear physics. He is head of the Radionuclide Metrology Sector of the European Commission's JRC-Geel in Belgium.

Primary author(s) : Dr. LUTTER, Guillaume (EC-JRC)

Co-author(s) : Mr. STROH, Heiko (EC-JRC-Geel); Mr. VANDAEL SCHREURS, Indy (University Hasselt); Mr. SCHROEYERS, Wouter (University Hasselt); Mr. CROYMANS-PLAGHKI, Tom (Universiety Hasselt); Dr. HULT, Mikael (EC-JRC-IRMM); Mr. MARISSENS, Gerd (EC-JRC-Geel)

Presenter(s) : Dr. HULT, Mikael (EC-JRC-IRMM)

Session Classification : Special Session: Metrology of NORM

Track Classification : Special Topic: Metrology of NORM