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Actinide L-line ED-XRF and Hybrid K-edge Densitometer Spectra Processing

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The analysis laboratory in the CEA Atalante complex at Marcoule (France) performs numerous R&D studies carried out in glove-boxes or in hot cells. Most of the samples are measured in liquid phase, aqueous or organic. The concentration of the main actinides of interest (U, Np, Pu, Am and Cm) are determined by XRF in a hot cell via their L-line X-ray between 13 and 15 keV. In order to limit the counting rate of many radioactive emitters (X-ray and gamma emitters) in the analysis solution and the continuous spectrum, a graphite monochromator is placed between the sample and detector. Commercial or free, the software packages available for processing X-ray spectra are designed and dedicated to a specific instrument and/or do not take into account the specific feature of our system in other words the presence of a monochromator. Therefore, a new X-ray analysis software program was developed for this particular system which takes into account matrix effects corrections. For sample with U and/or Pu in high concentrations, the hybrid K-edge densitometer is used. A new software program was also developed. For K-edge densitometry spectra processing, no calibration process is used. Spectra processing is based on theoretical equation and uses XCOM database for mass attenuation coefficients. Measured spectra on K-edge densitometer of Rokkasho Safeguards Analytical Laboratory were processed with this software and a very good agreement was found with IDTIMS results. The new graphical user interface allows to manually correct the defined edge. For the XRF spectra processing, new algorithms are used to define the base line and to find/integrate peaks. With these two analytical devices in laboratory, U and Pu concentrations can be measured from 0.5 mg.L⁻¹ to several hundred of g.L⁻¹.

Country or International Organization

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