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Elemental characterization by PGAA to support decommissioning activities

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The implementation of decommissioning tasks requires accurate radiological characterization to be accomplished. Often, computational codes are used to complement experimental radiological characterization campaigns. These activation codes need accurate knowledge of elemental composition of non-irradiated materials. Besides determination of most nuclides by the well-established Inductively Coupled Plasma – Mass Spectrometry (ICP-MS), Prompt Gamma Activation Analysis (PGAA) may be helpful in measuring light elements such as B, N, and Cl, that are known to be important precursors for medium (^3H) and long-lived (^{14}C and ^{36}Cl) neutron activation radionuclides. In fact, the assessment of N and Cl by ICP-MS is nearly impossible, whenever HNO_3 and HCl are employed to dissolve the sample.

The aim of this work is to complete the elemental characterization of nuclear grade graphite used as moderator and reflector in L-54M nuclear research reactor operated by Politecnico di Milano and now in deferred dismantling decommissioning. The bulk concentrations measured by PGAA resulted to be in agreement with ICP-MS and literature data, when available. Moreover, for the first time, depth distribution concentration profiles of N and Cl have been demonstrated. All data obtained by this innovative approach will be fed into the formerly developed activation code to accurately calculate radionuclides distribution in real samples and support their characterization before decommissioning.

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