Nuclear Forensic Investigations of High Purity Depleted Uranium Ammunition

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Sample attribution and their comparison are essential skills in a nuclear forensic investigation. Over the past two decades, the analysis of trace element impurities by sector-field inductively coupled plasma mass spectrometry (sf-ICP-MS) has become a valuable source of information. Today, lanthanoid impurities are known to be the most valuable source of information for sample attribution and comparison [1].

In this work, lanthanoid patterns, which have been extensively studied in the field of geology [2,3], are used in a nuclear forensic context to ensure reliable identification and comparison of uranium and thorium materials. Known methods lead to lanthanoid contamination and thus, to the modification of the said patterns [4]. The herein presented method addresses these shortcomings and can be used for the reliable quantification of lanthanoids. The obtained sensitivity allows lanthanoid quantification with a factor of 100 to 1000 lower, in comparison to previously established methods. This allows for a characterization of lanthanoid impurities down to the lower ppb (ng/g) to ppt (pg/g) range. Hence, the developed method is applicable to various high purity uranium materials such as nuclear fuel pellets and depleted uranium ammunition and fills an important analytical gap.

References:
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