Incorporating the Concept of Secondary Targets in Handheld X-ray Fluorescence to Increase Sensitivity of Minor Elements.

Chris McGlinchey[1], Bruce Kaiser[2], Therese Howe[2]

1: The Museum of Modern Art, New York, NY, 10019

2: Bruker Elemental, Kennewick, WA, 99336

Abstract

Secondary Targets were commonly integrated into the design of x-ray fluorescence (XRF) equipment in order to amplify a specific region of the emission spectrum. For several decades, this was the most common air path XRF method for the examination of cultural heritage. Equipment currently used in this field no longer utilizes this type of excitation geometry: surfaces are examined via direct excitation that may be filtered with films of varying elemental composition. Our work explores the possibility of adapting handheld XRF instrumentation using a modified approach to the secondary target concept. The geometry is different from the traditional approach: we simply place a small amount of encapsulated material in the beam-path to function as a secondary excitation source. It is essentially a modification to the existing filtering system. The merits of this approach are that signals not sufficiently above background can be enhanced such that their presence might be confirmed.

There are two variations to this approach: for analyzing x-ray dense materials, a small target element is placed in an envelope of ultrathin plastic between the source and the sample; and for x-ray transparent materials a backstop target can be used. This latter method has worked well for detecting low levels of Hg used in photographic papers via backstop containing Sr. Using this backstop amplification technique, the signal strength of Hg Kα increased by 20%. While this approach will thwart any efforts of quantitative analysis, it can help with positive identification of elements and may function as a screening tool for more advanced analytical methods.