**Synchrotron XRF/XAS Applications on Heritage glasses in Thailand**

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**Abstract**

Heritage glasses in Thailand mostly well known for their cultural values are antique, decorative mirrored glasses in Buddhist temples of the 13th to 19th century and prehistoric glass beads excavated from several archaeological sites around the country. During the last five years, we have successfully employed synchrotron radiation from Siam Photon Source [1] and soft-medium X-ray beamline BL8 [2] to study decorative mirrored glasses of various colors from the Temple of Emerald Buddha (Bangkok, Thailand). This type of glass is known in Thai as "kriab mirror". Oxide composition of the glass and metal composition of the mirroring alloy have been quantitatively determined by X-ray fluorescence (XRF) analyses with 2.5keV, 3.5 keV, and 10 keV synchrotron X-ray beams. The lower excitation energies effectively increase sensitivity of XRF detection of the siliceous matrix comprising sodium, magnesium, aluminum, phosphorous, lead, and potassium. The 3d transition elements such as Mn, Fe, Cu, and Co and their reduction-oxidation ratios accounting for the respective glass colors (yellow and blue) have been identified by X-ray absorption near edge structure (XANES) spectroscopy [3-4]. Our experimental results facilitate formulation of glass batches and the fabrication of new kriab glass with concordant colors, which are mandatory for conservative restoration of the Temple. Red kriab glass is much more challenging due to the low concentration of gold present as metal nanoclusters observed by XANES [5]. The synthesis of the gold-doped glass was carried out in an attempt to achieve the red coloration and the experimental result will be shown. In addition, we have investigated a heritage glass of the northern Thailand, namely "juen mirror". It is distinguishable by malleability of thin glass layer (100-200 µm) strongly glazed on thick metallic sheet. The XRF and XANES data of juen mirror will be reported in this work. As the lead content is remarkably high in this particular glass, lead speciation and implication on the glass color will be discussed. The third type of glass to be shown is indo-pacific beads of various colors. They were excavated from Khlong Thom archaeological area in the south of Thailand, dated back to about 10 AD. The XRF analyses of the glass beads will be compared to those of the different southern localities previously published [6].

**References**

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