XRF characterization using triple-crystal pyroelectric X-ray source

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Pyroelectric x-ray generation is already a commercially viable technology. However, continued research has the potential to significantly enhance its performance and broaden its range of applications. Its portability, compactness, and real-time operational capability make it particularly well suited for both laboratory and field applications [1-3]. This work presents a background investigation of several parameters aimed for the development of a miniature pyroelectric x-ray source employing triple $LiTaO_3$ crystals. The proposed configuration is specifically intended for X-ray fluorescence (XRF) applications, where stable output, compact geometry, and operational flexibility are critical. A conceptual illustration of the compact prototype design is shown in Fig. 1(c). The XRF measurements of the steel sample were performed using a triple-crystal $LiTaO_3$ setup, operated within a vacuum system maintained at 2×10^{-3} mbar. This configuration demonstrated improved spectral count rates in a shorter acquisition time compared to the results reported by Jun Kawai [4]. Fig. 1(a) is showing the spectra of steel sample acquired during the single cycle of cooling phase and Fig. 1(b) is showing the spectra acquired during the heating phase. Several additional samples, including lunar regolith simulants, will be tested with a focus on potential space applications.

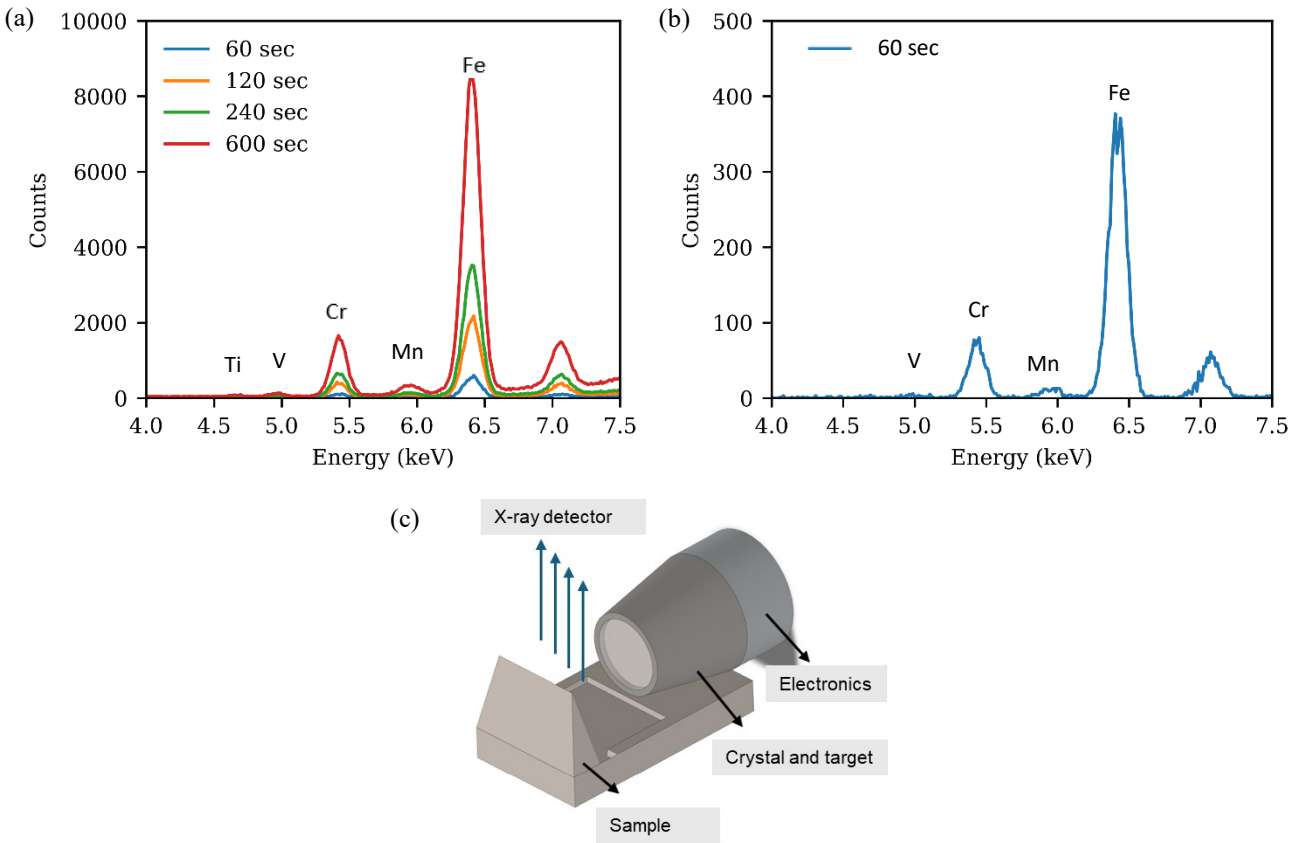

Figure 1. XRF spectra of a steel sample acquired during single cycle of (a) cooling, (b) heating phase under a vacuum pressure of 2×10^{-3} mbar. (c) design concept of miniature x-ray source.

Reference

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