

Implementation of a Novel Pure LaCl₃ Scintillation Detector for Hard X-Ray Diagnostics in Thailand Tokamak-1

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Enhancing the understanding of runaway electron behavior in fusion plasmas is important because runaway electrons can cause significant damage to plasma-facing components and pose a critical challenge to the safe operation of fusion devices. Following the first plasma discharge in July 2023, Thailand Tokamak-1 (TT-1)—the first small-sized tokamak in Thailand—has advanced toward achieving high-performance plasma operation and is being developed as a national platform for fusion plasma physics experiments. During ohmic plasma discharges, hard X-ray emissions were observed using LaBr₃(Ce) scintillation detector operated in pulse mode [1] and plastic scintillation detector operated in current mode. The hard X-ray signals appear during the plasma start-up phase, persist throughout the flat-top phase, and then rapidly decrease at plasma collapse.

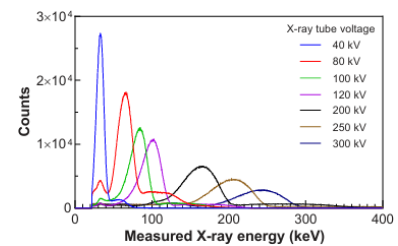


Figure 1. Measured X-ray energy spectra obtained with the pure LaCl₃ scintillation detector [2].

Although LaBr₃(Ce) have demonstrated good performance for hard X-ray spectroscopy, further development of novel scintillation detectors is required to meet the demanding operational conditions of fusion plasma experiments. Recently, a newly developed pure LaCl₃ scintillation detector has been investigated for its feasibility in hard X-ray measurements (see Figure 1) [2]. In this work, the implementation of a pure LaCl₃ scintillation detector system for hard X-ray spectroscopy on the TT-1 is presented. The first hard X-ray spectral measurements obtained using a pure LaCl₃ scintillation detector will be reported in this work. These results demonstrate the feasibility of pure LaCl₃ scintillators for hard X-ray diagnostics in fusion plasmas and provide a foundation for the further development and application of advanced scintillation-based diagnostic systems.

1. K. Rongpuit, et al., “Initial results of hard X-ray spectroscopy by LaBr₃(Ce) detector for runaway electron study in Thailand Tokamak-1”, *Radiation Physics and Chemistry* **227**, 112346, 2025.
2. K. Ploykrachang, et al., “Feasibility and characterization of a pure LaCl₃ scintillation detector for hard X-ray measurements in Thailand Tokamak-1”, *Radiation Physics and Chemistry* **240**, 113471, 2026.

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