

Crystal growth and optical properties of benzoic acid crystals for neutron scintillator

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Novel applications of neutron have been developed such as imaging method using a pulsed neutron source and neutron resonance absorption spectroscopy. These methods require position sensitive detectors for neutron with the Time-of-Flight (TOF), and one of the issues is development of fast response scintillator. Some of halide scintillators show high light yield and fast decay time, however, most of them are hygroscopic. Then, we focused on the organic scintillator crystals, which showed fast decay time in the nanosecond range and no hygroscopic nature. Their constituent elements include hydrogen which shows high reaction cross-section to thermal and fast neutron. However, conventional organic scintillator has low melting temperatures and would degrade with overheating. Therefore, we have developed organic crystals for neutron scintillators with high melting temperatures and fast decay times. In this work, we focused on benzoic acid crystals which include pi bonds in the molecular orbital. Thus, we grew benzoic acid crystals from the melt and evaluated their scintillation properties for neutron scintillator.

Benzoic acid crystal was grown by self-seeding vertical Bridgman method using an enclosed chamber [1]. Raw material powder was charged into a double glass ampoule and the atmosphere in the chamber was replaced with high purity nitrogen. The ampoule was heated by a resistance heater and pulled down slower the rate of 0.03-0.06 mm/min. The grown crystals looked transparent. The scintillation decay were measured by using a ²⁵¹Cf isotope as neutron source. The detailed results are presented on the presentation.

References

[1] A. Arulchakkaravarthi, P. Jayavel, P. Santhanaraghavan, P. Ramasamy, J. Crystal Growth 234 (2002) 159-163.

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Author: YAMAJI, Akihiro

Co-authors: KUROSAWA, Shunsuke; Dr OHASHI, Yuji (Institute for Materials Research, Tohoku University, Sendai, Japan); Prof. YOKOTA, Yuui (NICHe, Tohoku Univ.); Prof. KAMADA, Kei (NICHe, Tohoku Univ., C&A Corp.); YOSHIKAWA, Akira (Tohoku University)

Presenter: YAMAJI, Akihiro

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