

The Li-containing compound semiconductor thermal neutron detector is based on the ${}^6\text{LiInSe}_2$ single crystal. A novel ${}^6\text{Li}$ chemical purification method and proprietary two-step synthetic process that starts from elementary materials (Li, In and Se) yield large radiation detection quality crystals of ${}^6\text{LiInSe}_2$. The harvested crystal also must exhibit the appropriate electrical bandgap, high bulk resistivity and current stability. These ${}^6\text{Li}$ -containing chalcopyrite-type semiconductor crystals efficiently detect thermal neutrons at room temperature by either direct semiconductor conversion of ${}^6\text{Li}(n,\alpha)$ charged particles or detection of scintillation photons via a coupled solid state photodetector.

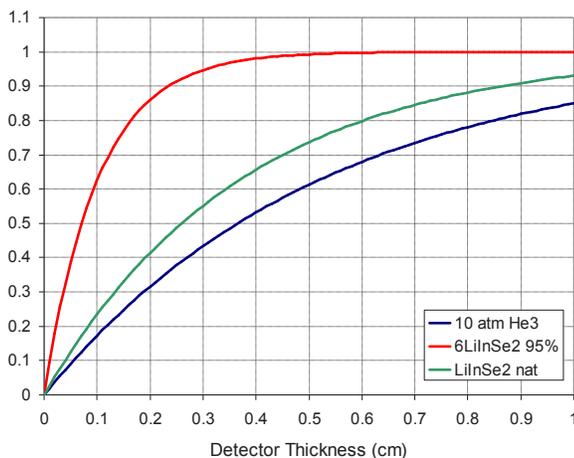
DETECTOR / SENSOR / IMAGING

Features

${}^6\text{LiInSe}_2$ crystal properties:

- Band gap: 2.8 eV
- Bulk resistivity: $>10^{12} \Omega\cdot\text{cm}$
- Optical transmission: 60%

High thermal neutron efficiency

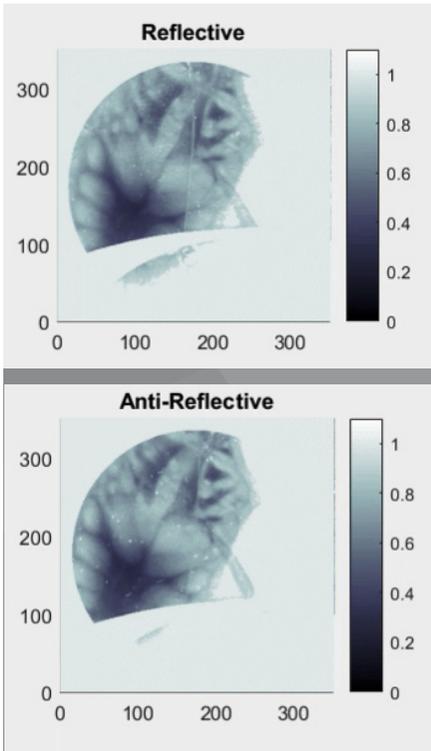


Benefits

- Compact, low cost, low energy
- All solid state detection
- Versatile design for a wide-range of applications (hand-held, high resolution, bulk counter, imaging)
- High intrinsic gamma/neutron discrimination

Applications

- Neutron science facilities or neutron detection and imaging entities will be interested in increased spatial resolution and detection efficiency possible.
- Industrial firms in the oil industry and transportation providers would be interested in the detection and security benefits.
- Government agencies with research or operation interest in nuclear nonproliferation, radiation detection and homeland security.
- Non-linear optics.
- Medical imaging.



Patents & Awards

- U.S. Patent Nos. 7,687,780; 9,334,581; and 9,429,662
- U.S. Patent Applications 14/230,372; 14/453,768; 14/871,162; 14/752,048; 14/729,715; and 14/843,150.
- 2013 R&D 100 Award

Inventors

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Technology Readiness Level (1–9)



⁶LiInSe₂ crystals of sufficient size and bulk electrical properties are readily made in the laboratory, and detection of ionizing radiation has been successful with rudimentary detector archetypes.

Partnering Opportunities

Y-12 is seeking an industry partner to fully commercialize this technology.

If you would like more information, please contact the Office of Technology Commercialization and Partnerships:
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