ID de Contribution: **16** Type: **Non spécifié**

Neutron characterization of scintillators for neutron metrology from 100 keV to 22 MeV

vendredi 19 janvier 2024 12:05 (25 minutes)

The Laboratory for micro-irradiation, neutron metrology and dosimetry (LMDN) is responsible for establishing metrological references in France for neutron fluence energy distributions and associated dosimetric quantities. The LMDN has acquired four 2"x2" scintillators for these metrological purposes; two stilbenes and two EJ309. The aim of this work is to characterize these scintillators, which are coupled to a digital acquisition system. The total energy range is 100 keV and 22 MeV, although the energy range of each scintillator is limited. Response times are fast enough to use the time-of-flight (ToF) measurement technique.
Stilbenes are crystalline organic scintillators with good energy resolution and sensitivity, capable of detecting neutrons up to 100 keV. In fact, new methods for manufacturing stilbene crystals have made it possible to reduce the energy threshold to 100 keV and improve discrimination between neutrons and gammas. However, stilbene has an anisotropic response, and EJ309 scintillators are also chosen by the LMDN because, although their measurement threshold starts at a neutron energy of 1 MeV, their response is isotropic. These two types of scintillator were chosen because they have no safety restrictions.
Response function shapes are determined from white neutron fields at Neutron For Science (NFS) between 100 keV and 22 MeV using ToF. Neutron fluence references are determined at the Physikalisch-Technische Bundesanstalt (PTB) on the main monoenergetic component of neutron fields at several neutron energies (1.2, 2.8, 5.0, 14.8, 17.0 and 19.0 MeV). For measurements at 5.0, 17.0 and 19.0 MeV, the beam is pulsed to enable for scintillators to select in a time window the main monoenergetic component.
These measurements provide a complete characterization of neutrons between 1 MeV and 22 MeV. The 100 keV - 1 MeV decade is measured a stilbene and is largely understudied. A specific study needs to be carried out to determine neutron fluence using the PTB fluence reference at 1.2 MeV.
To complete the neutron field characterization, the photon response function has also been established.
Full characterization of these scintillators will enable the LMDN to determine the energy distribution of the neutron fluence and the associated photon field.

Auteurs principaux: QUEVAUVILLERS, Diane (IRSN/LMDN Cadrache); Dr PETIT, Michael (IRSN/LMDN Cadrache)

Co-auteurs: Dr REYNARD-CARETTE, Christelle (Aix Marseille Univ, Université de Toulon, CNRS, IM2NP, Marseille, France); Dr OTTAVIANI, Laurent (Aix Marseille Univ, Université de Toulon, CNRS, IM2NP, Marseille, France)

Orateur: QUEVAUVILLERS, Diane (IRSN/LMDN Cadrache)

Classification de Session: Session 7