Contribution ID: **60** Type: **Oral Presentation**

#4-60 SiC neutron detectors for subcritical system monitoring and education applications

Tuesday, June 10, 2025 2:20 PM (20 minutes)

Silicon carbide (SiC) semiconductor radiation detectors are being researched in the field of radiation detection as a promising technology offering superior performance characteristics that address many limitations of traditional detector materials, thanks to inherent advantages of SiC. These are, for radiation detection in particular, its wide bandgap, high thermal conductivity and exceptional radiation hardness, which make SiC highly suitable for use in harsh environments.
This paper presents research into the application of SiC detectors for measurements of the neutron flux in a nuclear reactor in subcritical conditions, relevant for neutron measurements / monitoring of subcritical and zero power reactors or spent fuel facilities. This application is made possible by the implementation of wide area SiC Schottky Barrier Diodes (SBDs) enabling high detection efficiency. Two wide area SiC SBDs were fabricated at the National Institute for Quantum Science and Technology in Japan. 6LiF converter layers were realized by dispersing 6LiF powder in ethanol and subsequent deposition on the front contact of the SiC SBDs. Measurements were performed in the Jožef Stefan Institute TRIGA research reactor in Slovenia in subcritical conditions, at neutron flux levels in the source range, with the objectives to monitor the neutron population during a controlled approach to criticality and to measure the axial neutron flux distribution in steady-state subcritical conditions. Measurements were carried out using the Libera MONACO 3 fission chamber data acquisition system, developed at the French Atomic and Alternative Energies Commission (CEA), and commercialized by the Instrumentation Technologies company in Slovenia. The results obtained demonstrate excellent performance of SiC detectors for measurements in subcritical conditions.
The application of SiC detectors for neutron measurements is also particularly suitable as an experimental activity in nuclear education, due to the fact that the experimental setup can be made visually more interesting compared to e.g. sealed gaseous detectors. The use of standalone neutron converters makes it possible to observe and visualize the response of a SiC detector to charged particles from a radioactive source, or charged particles due to neutron interactions, as well as attenuation in the air gap between the source/converter and the detector, or self-absorption effects in the converter layer. Experiments with SiC detectors can therefore enable demonstrations of a range of phenomena relevant for neutron / charged particle detection, facilitating understanding and knowledge retention, and have already been implemented at the JSI in the framework of hands-on education activities organized by the European Nuclear Experimental Educational Platform (ENEEP).

Primary author: RADULOVIĆ, Vladimir (Jožef Stefan Institute)

Co-authors: BISIACH, Danilo (Instrumentation Technologies doo); MAKINO, Takahiro (National Institutes for Quantum and Radiological Science and Technology)

Presenter: RADULOVIĆ, Vladimir (Jožef Stefan Institute)

Session Classification: #04 - Research Reactors and Particle Accelerators

Track Classification: 04 Research Reactors and Particle Accelerators