AGA 1: Nuclear Safeguards

Time: Wednesday 15:00–16:30 Location: B 0.014

AGA 1.1 Wed 15:00 B 0.014

Study of Neutron Detection Technologies Using ^{6}Li as a Replacement of ^{3}He — Theo Köble, •Charlotte Bornhöft, Olaf Schumann, and Wolfram Berky — Fraunhofer-Institut für Naturwissenschaftlich-Technische Trendanalysen INT, Appelsgarten 2, 53879 Euskirchen

Within the past decade a significant shortage of ^{3}He and correspondingly an enormous increase in cost has occurred. ^{3}He is widely used in neutron detection applications, e.g. by first responders, during on-site inspections, and in other applications where nuclear and radioactive material has to be detected, localized and possibly identified. Therefore replacement materials need to be considered, selected, implemented in a corresponding detector, and thoroughly tested.

One of these promising basic elements is ^{6}Li which is utilized in detector applications such as the scintillation materials CLYC (Cs_2LiYCl_6:Ce), and CLLB ($Cs_2LiLaBr_6$:Ce). These two detector types even offer the possibility of simultaneously measuring neutrons and gamma radiation with good discrimination capability. Within the detection materials neutrons are captured by ^{6}Li, triggering the nuclear reaction ^{6}Li(n,α)^{3}He. The secondary particles then create light pulses in the scintillation crystal which ultimately serve as detection signals. The neutron and gamma radiation result in different pulse shapes which allow the discrimination.

We performed test measurements with both scintillation materials; the results gain information for further use as material in measurement systems in the field of nuclear safety and security.

AGA 1.2 Wed 15:30 B 0.014

Production and Characterisation of Microparticle Reference Materials for Particle Analysis in Nuclear Safeguards — •Stefan Neumeier, Philip Kegler, Martina Klinkenberg, Irmgard Niemeyer, and Dirk Bosbach — Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research * Nuclear Waste Management and Reactor Safety (IEK-6), 52425 Jülich, Germany

The International Atomic Energy Agency (IAEA) implements safeguards measures in order to verify that member states are in compliance with their international legal obligations to use nuclear material and technology only for peaceful purposes. Safeguards measures, inter alia, include analytical measurements of samples taken during inspections at nuclear facilities. While the use of analytical techniques by the IAEA constantly requires quality control and further advancement, particle reference materials are needed for enhancing particle analysis methods in safeguards. This presentation reports on the development of an installation at Forschungszentrum Jülich capable of the production of microparticles, which are intended to be used as source material for certified reference materials. The first part of the presentation addresses the process development and optimization, e.g. influence of precursor chemistry on particle morphology. The second part discusses the particle characterization and analysis by electron microscopy, mass spectrometry and μ-X-ray methods.

AGA 1.3 Wed 16:00 B 0.014

Detection of nuclear reprocessing activities using Kr^{85} — •Pablo Woelk, Markus Kohler, Carsten Sieveke, Simon Hebel, Ergin Simsek, Christoph Becker, Klaus Sengstock, and Gerald Kirchner — Universität Hamburg, Deutschland

An increased concentration of the isotope Kr^{85} in atmospheric air samples combined with atmospheric calculations is an excellent indicator for detecting nuclear reprocessing activities.

For an effective detection, small sample sizes and a high sample throughput rate are necessary. These factors place high demand on the measuring technology.

Our Atom Trap Trace Analysis (ATTA) experiment aims to measure the concentration with a magneto-optical trap. This method allows to capture specific isotopes and is sensitive to the part-per-trillion level.

Established implementations using the ATTA method allow high sensitivity but have a limited sample throughput rate, since the vacuum chambers need to be flushed after each measurement to avoid cross contamination due to the RF-driven excitation into the metastable state. Here, however, we are producing metastable Kr all-optically, avoiding cross contamination.

Our experiment includes the entire measuring chain. Besides the actual concentration measurement this includes an in-house developed autonomous air sampling as well as automated sample preparation.