"Why Neutron Scattering?"

Prof.dr. Don Kearley (IRI Delft)

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Neutrons for science, medicine and industry - first results from the new neutron source FRM-II

Prof.dr. Winfried Petry (Technische Universität München)

The high flux neutron source FRM-II of the Technische Universität München produced its first neutrons on March 2, 2004 and is meanwhile operating at full power of 20 MWatt. The nuclear concept of its compact core, its spectral transformers like cold and hot source, converter for fast neutrons and positrons will be presented and compared to its measured performance. Further, first results from its advanced instruments like positron source, tomography, elastic and inelastic scattering facilities will be shown. Finally the perspectives of neutron sources operated by universities will be briefly discussed within the European context."

Transmutation and fuel research in the HFR Petten

Dr. Ronald Schram (NRG)

The High Flux Reactor in Petten is used for research on fuels and materials for innovative fuel cycles and reactors. Both transmutation and GenIV-related research programmes play an important role in the research portfolio of the HFR. The HFR has a large number of irradiation devices for instrumented experiments on fuels and non-fissile materials. The background of transmutation scenarios will be discussed. The challenge is to design and fabricate innovative fuels that can be used to reduce the nuclear waste inventory in a safe and economic way. Examples will be given of the research on transmutation fuels and targets, such as inert matrix fuels for the incineration of plutonium and Americium and targets for Technetium and Iodine transmutation. In addition, innovative projects on the improvement of LWR fuel and HTR fuel will be discussed.

Materials research with nuclear reactor based positron beams

Dr.ir. Henk Schut (IRI Delft)

After the postulation by Dirac in 1930 of the positron as the negative energy extension in his theory of electron energy levels and the discovery of the positron by Anderson in 1932 in a cloud chamber photograph the start of positron physics occurred in the early fifties. In this period it was realized that the characteristics of the annihilation process depend mainly on the state of the positron-electron system in matter and thus could be used to investigate material properties.
Parallel to this development researchers started to look for methods to obtain energy controlled positrons as it was recognized that the continuous energy distribution of positrons emitted by radio-isotopes was a limitation of the capabilities of the positron as a material probe. In the seventies the understanding of the positron slowing down, thermalization, diffusion and trapping processes was at a level that the first source-based beams of positrons emerged therewith enabling the investigation with positrons of surfaces and subsurface layers and interfaces. Mainly due to the development of efficient positron moderators (from single crystals to solid rare gases) source based beams with intensities up to typically 10^6 s^{-1} are now in use for e.g. positron Doppler Broadening, Positronium-fraction, Positron induced Auger Electron Spectroscopy and positron lifetime beam experiments. For applications such as two dimensional angular correlation of annihilation radiation (2D-ACAR), positron micro-beams and time efficient positron lifetime more intense positron beams ($>10^8$ s^{-1}) are necessary.
Today the operational intense positron beams can be divided into two categories: electron accelerator and nuclear reactor based beams. In accelerator based beams positrons are generated through the conversion of high energy Bremsstrahlung, emerging from the interaction of the electrons with the target, into positron-electron pairs. For the reactor based beams positrons are also generated via this pair production reaction, but now the necessary high energy photons are delivered by either the conversion of neutrons into high energy gammas or as in case of the Delft Hoger Onderwijs Reactor (HOR) by the prompt gammas from the fission reactions.
In this presentation an overview will be given of the different positron annihilation techniques and their capabilities as probes in materials research. With respect to the production and application of intense positron beams the focus will be on the Delft positron beam POSH.

Titel: Reactor-produced radionuclides in radiotherapy: clinical use and production-demands

door: Dr. Wout Breeman (Erasmus MC)

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