ST 6: Poster Session

Time: Thursday 14:15–15:45 Location: Redoutensaal

ST 6.1 Thu 14:15 Redoutensaal

WO3-based polymer composites for radiation protection — •Maria Stefanova[1], Stefani Bogoeva[1], Vladimira Videva[1], Strahil Georgiev[2], Dimitrina Petrova[1,3], Vera Marinova[1], and Dimitre Dimitrov[1,4] — [1]Institute of Optical Materials and Technologies, Bulgarian Academy of Sciences, Sofia, Bulgaria — [2]Faculty of Physics, Sofia University,1164 Sofia, Bulgaria — [3]Faculty of Engineering, South-West University, 2700 Blagoevgrad, Bulgaria — [4]Institute of Solid State Physics, BAS, 1784 Sofia, Bulgaria

Lead-based radiation shielding materials, though effective, are limited by their toxicity, rigidity, and environmental hazards. This study explores a polymer composite incorporating tungsten trioxide (WO3) as a lead-free alternative for gamma and X-ray protection. WO3 was selected for its high atomic number, density and chemical stability, offering efficient attenuation with lower ecological impact. Composites with varying WO3 concentrations were synthesized and evaluated for mechanical properties, microstructural uniformity and radiation shielding efficiency. Preliminary results indicate that WO3*polymer composites achieve comparable attenuation to conventional lead materials while exhibiting superior flexibility, lower weight and non-toxicity. These findings demonstrate the potential of WO3-filled polymers as sustainable materials for radiation-protective equipment.

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Tracking Polymeric Residues in Silicone Implants and Adjacent Tissue via Raman Spectroscopy and CNN-Based Classification — •Hoang Thinh Nguyen[1], Susanne Gramsall[2], Rima Nuwayhid[3], and Paul-Tiberiu Miclea[1,2] — [1]Martin Luther University Halle-Wittenberg, Institute of Physics, MicroMD Group — [2]Fraunhofer Center for Silicon Photovoltaics, Halle (Saale), Germany — [3]University Hospital Leipzig, D-04103 Leipzig, Germany

Silicone breast implants are widely used in reconstructive and aesthetic surgery. While silicone is generally considered biologically inert, concerns remain regarding long-term biocompatibility and potential microplastic release. Six samples (2 explanted implants, 4 surrounding tissue specimens) were analyzed using Raman spectroscopy combined with CNN-based spectral classification. Implant surfaces were examined directly, while tissue samples underwent KOH digestion and filtration onto silicon membrane filters (1 micrometer pore size). A Mask R-CNN model trained on about 50 reference spectra with an 8:2 split outperformed SVM and KNN. Raman mapping detected PVC on implant surfaces. In tissue, polymeric residues were found (primarily silicone), but also non-silicone polymers such as PS and PVC, near 960 cm-1 and 1600 cm-1. These results suggest migration of polymer components into surrounding tissue and support links to implant-related inflammatory responses.

ST 6.3 Thu 14:15 Redoutensaal

Comparison of Proton Beam Dose Profiles in matRad and Geant4 Simulations — •Mariam Abuladze[1], Revaz Shanidze[2], Beka Bochorishvili[2], Nikoloz Tchikadze[3], and Achim Stahl[4] — [1]Kutaisi International University, Kutaisi, Georgia — [2]Tbilisi Stare University, Tbilisi, Georgia — [3]Todua Clinic, Tbilisi, Georgia — [4]RWTH Aachen University, Aachen, Germany

Cancer treatment is one of the most pressing issues in the modern world, and proton therapy is one of the main methods used to combat this disease. Protons Coulomb Interactions with electrons and nuclei there are well tested methods that describe these interactions very well. In contrast nuclear interactions are more complicated to describe so accurately as Coulomb interactions. In order to account for nuclear interactions in dose calculations, it is necessary to use higher-precision Monte Carlo modeling. In this work we compare doses calculated by two software tools, one uses Monte Carlo calculations the other not. In order to compare calculated doses by these two software tools we study simplest case: homogeneous water medium and monochromatic proton beams. The study investigates absorbed doses obtained using two software tools: matRad and Geant4 and obtained dose distributions and lateral profiles are compared. According to the results besides some differences in dose profiles dose distributions are closer enough according to clinical standards.

ST 6.4 Thu 14:15 Redoutensaal

Thin Film Scintillators for α-Particle Detection — •Kim Tabea Giebenhain, Hans-Georg Zaunick, and Kai-Thomas Brinkmann — 2nd Physics Institute, Justus Liebig University, Giessen, Germany

Reliable detection of α-particles is one of the core tasks in Radon detection, since relevant Radon isotopes decay by α-emission.
For the development of an efficient and cheap Radon detector, multiple thin scintillator materials were tested to increase the effective area of an existing detector system, while still maintaining a low-cost photodetection setup and good background suppression.
This works present the findings on the light transport of 50 μm thick Polyethylene-Naphthalate foils and thin coatings of scintillating paint EJ-296 on acrylic glass, read out by a dual-SiPM system.

ST 6.5 Thu 14:15 Redoutensaal

Design-Oriented Monte Carlo Evaluation of Tungsten Oxide-Loaded Flexible Polymer Shields for Diagnostic Photon Energies — •Türkan Alkan[1] and Hakan Epik[2] — [1]Vocational School of Health Services, Izmir University of Economics, Balçova, Izmir 35330, Turkey — [2]Department of Physics, Faculty of Science, Dokuz Eylul University, Buca, Izmir 35160, Turkey

Flexible and lead-free radiation shielding materials have attracted significant attention as safer alternatives to conventional protective systems. This study aims to systematically evaluate the photon attenuation behavior of tungsten trioxide (WO_3)-reinforced PVA/PEG polymer composites within the diagnostic X-ray energy interval (20-150 keV) using a Monte Carlo-based modeling approach.

Composite structures containing 0-40% WO_3 by volume were computationally modeled using the GAMOS (GEANT4-based) simulation platform. Energy-dependent mass attenuation coefficients were obtained from transmitted photon fluence under narrow-beam conditions. Linear attenuation coefficients, half-value layer (HVL), tenth-value layer (TVL), and mean free path (MFP) were subsequently derived to quantify shielding efficiency across all compositions.

Increasing WO_3 loading produced a pronounced enhancement in attenuation performance, particularly at lower photon energies dominated by photoelectric interactions. The composite containing 40% WO_3 demonstrated the strongest shielding capability, exhibiting substantial reductions in HVL and MFP compared with the unfilled matrix. These findings indicate that tungsten oxide incorporation significantly improves photon interaction probability while enabling thinner shielding structures.

The simulation outcomes confirm that WO_3-reinforced PVA/PEG composites represent promising candidates for flexible, lead-free shielding applications in diagnostic radiology. The presented Monte Carlo framework provides a practical tool for guiding material selection and optimizing filler concentration prior to experimental fabrication.