



Contribution ID: 47

Type: **Talk**

Radiopure PEN for Rare-Event Searches

Thursday, 3 October 2024 11:25 (25 minutes)

Achieving the scientific goals of rare-event searches, such as dark matter and neutrinoless double-beta decay detection, hinges on stringent background reduction. Utilizing materials with outstanding radiopurity that can additionally self-veto internal background radiation is critical for meeting these requirements. Poly(ethylene-2,6-naphthalate) (PEN) has emerged as a highly promising candidate for cryogenic rare-event searches due to its intrinsic scintillation and wavelength-shifting properties, along with its structural stability at both room and cryogenic temperatures. In the LEGEND-200 neutrinoless double-beta decay experiment, commercial PEN has already been successfully implemented as an optically active and structural component. To meet the more demanding background reduction needs of future experiments, such as LEGEND-1000, we are advancing the self-synthesis of glycol-modified PEN (PEN-G). This presentation will cover the production of commercial PEN components and the synthesis of PEN-G, focusing on their optical properties, structural performance, and radiopurity. Additionally, we will explore the future applications of radiopure PEN in next-generation rare-event searches. This research is funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - Excellence Cluster ORIGINS EXC 2094-39078331; SFB1258-283604770.

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Session Classification: Production of Radiopure Materials