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A new tellurium-loaded liquid scintillator based on water and p-dioxane

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Tellurium-loaded liquid scintillators are critical for neutrinoless double-beta decay experiments, but conventional formulations face limitations in tellurium loading due to solubility and chemical compatibility issues. In this work, we develop a novel surfactant-free, water-compatible liquid scintillator based on p-dioxane, incorporating telluric acid, water, and naphthalene, with PPO as the fluor. A ternary solubility phase diagram of the tellurium–water–p-dioxane system was established, enabling the identification of stable compositions that accommodate both desired tellurium content and scintillation performance. Efficient energy transfer from solvent to fluor was achieved through the intermediate role of naphthalene, and the optimized formulation exhibited light yield comparable to conventional organic scintillators. Despite quenching effects introduced by water and telluric acid, these results demonstrate the feasibility of surfactant-free, water-compatible tellurium-loaded scintillators. This work serves as a proof of concept for a new design framework toward high-loading liquid scintillators.

Collaboration you are representing

Jinping Neutrino Experiment

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