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Low-temperature Optical Properties of Materials for Rare-event Searches

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Many particle detectors house their liquid scintillators in an acrylic vessel. The acrylic may be coated by a wavelength shifter in situations where the scintillation light is outside the range of the photodetectors. We have investigated the low-temperature properties of pyrene as an alternative to 1,1,4,4-tetraphenyl-1,3-butadiene (TPB) as pyrene has a much longer fluorescence time which could be useful for pathological background rejection in a detector. The fluorescence properties were studied for various concentrations and fluorescence grades of pyrene in the pyrene-polystyrene coatings. In addition, we have studied the fluorescence of the acrylic itself, as it could form a background in rare-event searches and compared the light yield results to those of TPB. All these materials were excited with 285 nm UV light and studied at various temperatures between 4 K and 300 K to cover the operating temperatures of most particle detectors. We present the changes in the spectra and light yields of all these materials with temperature and discuss an additional analysis of the change in the temperature dependence of the pyrene fluorescence time constants.

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Please select: Experiment or Theory

Instrumentation

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Session Classification: Instrumentation