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PLASTIC SCINTILLATOR, EXPLORATION OF PHOTO-PHYSICAL PROPERTIES AND CHEMICAL OPTIMISATION

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Thanks to a good ratio between cost and performances, plastic scintillators are now in the center of radiation detection applications. But due to the fact that most of the formulations were created in the 50's, there is now a huge incentive in creating new recipes, due to increasing need of large scale detectors. The conversion of high energy ionisation to a visible photons emission is called scintillation. This process implies charge and exciton transport inside the bulk of the plastic. Different input ionisation (alpha, beta, gamma and neutron) give different ionisation trace and can lead to slight modification of the emission characteristics; hence leading to identification of the ionising particle. We are presenting here a comprehensive model of gamma and neutron interaction in plastic scintillators and the photophysical mechanism associated with gamma/neutron discrimination, with a particular emphasis on excited triplet state diffusion and recombination inside amorphous polystyrene matrices. More than the model, several chemical modifications of the polymer matrix as well as additives can enhance different scintillation properties. More particularly, addition of metal additives, high concentration of fluorophores, modification of the polymeric matrices and addition of cross-linking agents are essential for specializing the plastic towards a particular application. Here, again understanding charge and exciton transfers are central to optimize formulation. One of the main examples is the choices of heavy metal additives for enhancing properties. We will present here, our work on organometallic insertion inside plastic matrices and optimization of the formulation towards better scintillation properties.

Biography

Bertrand Guillaume is a Researcher at CEA Saclay near Paris, in France. He is an Organic Chemist and likes to apply chemical designs to materials science and more particularly light/matter interaction. His areas of research of interest include photovoltaic, organometallic and inorganic chemistry and porous materials. He is now specializing in design and optimization of plastic scintillator for nuclear instrumentation. His research interests include polymer chemistry, plastic scintillator, photophysic and organometallics.

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