Organic Scintillator

KEYWORDS

- ❑ TIME DETECTOR
- ❑ DOSIMETRY
- ❑ TRACKERS
- ❑ BEAM MONITORS
- ❑ MEDICAL IMAGING

AREA

- ❑ BIOMEDICAL

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Patent Type
Patent for invention

Co-Ownership
Sapienza Università di Roma 93%, Museo Storico della Fisica e Centro Studi e Ricerche E. Fermi 7%

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Industrial & Commercial Reference
Organic plastic scintillator production of high quality and performance in terms of light output and timing.

Time to Market
The invention has a degree of development with TRL ranging between 4 (Tech. validated in the laboratory) and 5 (Tech. validated in a relevant environment)

Availability
Cession, Licensing, Research, Development, Experimentation, Collaboration and Start-up.

Fig. 1 Solid state scintillator (UV illumination)

Fig. 2 Liquid scintillator (daylight/UV lighting)

Abstract
Plastic scintillators are ionizing radiation detectors used in various fields of application such as environmental monitoring, medical imaging, γ ray and particle detection, and more. They consist principally of a fluorophore, responsible for the absorption and conversion of the kinetic energy of the particles into lower-energy light radiation and sometimes a secondary dopant dissolved in a plastic polymer matrix. Obtaining homogeneous, light, machinable, transparent and high-performance plastic objects is one of the main challenges of this research line.

Fig. 3 Plastic scintillator

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Organic Scintillator

Technical Description

This patent concerns the synthesis of a new series of organic molecules which can be used as fluorophores in plastic scintillators. For the type of molecular architecture adopted, the molecules showed high solubility in organic solvents precursors of plastics, such as vinyl toluene, even at high concentration values. This aspect allowed to obtain, after polymerization process, highly homogeneous and transparent final plastic objects with a high degree of hardness and machinability. In addition, these molecules have shown excellent optical properties regarding the amount of light produced and the speed of light response. From a temporal point of view these characteristics are optimal for the realization of fast and light detectors.

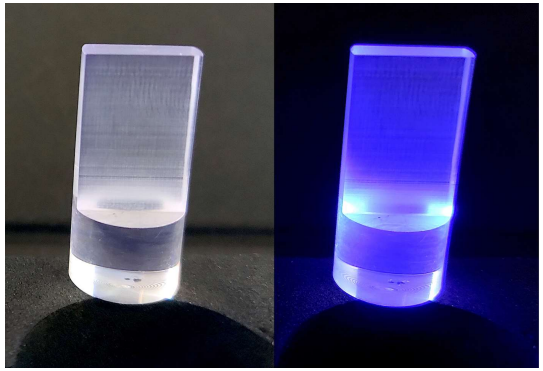

Fig. 4 Plastic scintillator after machining (daylight/UV lighting).

Technologies & Advantages

The invention product shows more advantageous characteristics than the organic scintillators currently on the market, both in terms of temporal characteristics and light production. Moreover, the new organic molecules, synthesized to be used as fluorophores, were obtained by reactions of classical organic synthesis (only 2 reaction steps) in very high reaction yields, higher than 90%. This last aspect is particularly important from the industrial point of view, since large quantities of organic fluorophore can be synthesized with low production costs and in acceptable reaction times, in order to have plastic scintillators with high concentrations of luminescent dopant. In addition, such molecules have the advantage of being obtained with a high degree of purity by simple purification techniques such as crystallization or extraction, thus avoiding the use of chromatography.

Applications

Fast time detectors for elementary particle physics; Detectors for the identification of particles through dE/dx method; Flash therapy dosimeters; Personal dosimeters.

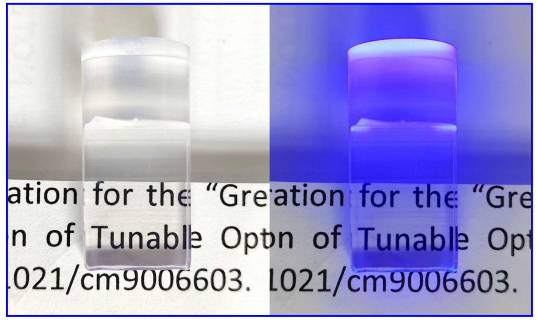

Fig. 5 Plastic scintillator after machining and polishing (daylight/UV lighting)

Fig. 6 Main characteristics of the scintillators under examination. Test carried out with particles at minimum ionization.

Samples	Primary Dopant	Wavelength emission	Light Output* % EJ232	Rise-Time [ns]	Width [ns]	Time Resolution [ps]
	%	[nm]	*systematic and statistics error 10%*			
EJ-232	-	370	100	2	9	123
EJ-204	-	408	200	2.5	11	211
2N	14%	405	110	2	12	81
2T	14%	-	240	3	18	97
1N	14%	415	155	3	17	102
2B	14%	420	160	2.5	14	110

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