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(54) Title: PLASTIC SCINTILLATOR WITH EFFECTIVE PULSE SHAPE DISCRIMINATION FOR NEUTRON AND GAMMA DETECTION

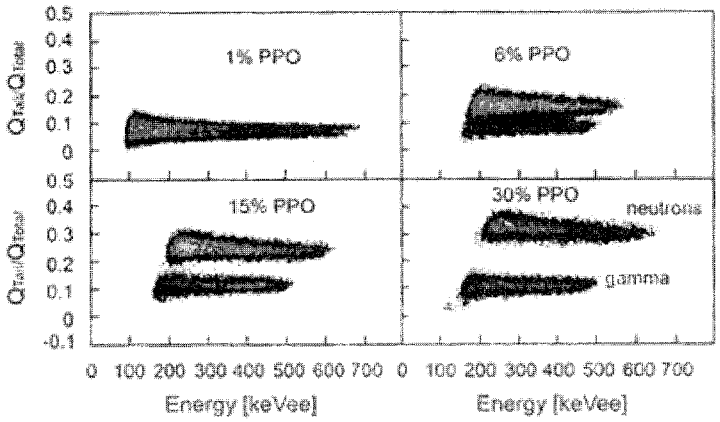

FIG. 9

(57) Abstract: In one embodiment, a scintillator material includes a polymer matrix; and a primary dye in the polymer matrix, the primary dye being a fluorescent dye, the primary dye being present in an amount of 5 wt% or more; wherein the scintillator material exhibits an optical response signature for neutrons that is different than an optical response signature for gamma rays. In another embodiment, a scintillator material includes a polymer matrix; and a primary dye in the polymer matrix, the primary dye being a fluorescent dye, the primary dye being present in an amount greater than 10 wt%.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

C09K 11/06(2006.01)i, G01T 1/203(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C09K 11/06; G01T 1/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: scintillat*, fluorescen*, polymer matrix, dye, fluor, neutron, gamma ray, initiator, pulse shape discrimination, diphenyloxazole(PPO), (POPPO), (DPA), polystyrene, polyvinyltolune.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4127499 A (CHEN, TSANG J. et al.) 28 November 1978 See abstract; column 6, line 25 - column 10, line 11; all examples.	16,17,19-28,30
A	See the whole document.	1-15,18,29
X	US 2006-0054863 A1 (DAI, SHENG et al.) 16 March 2006 See abstract; paragraph [0095].	16,17,19-28,30
A	See the whole document.	1-15,18,29
PX	ZAITSEVA N. et al. "Plastic scintillators with efficient neutron/gamma pulse shape discrimination", Nuclear Instruments and Methods in Physics Research A, Vol. 668, Pages 88 - 93, 13 December 2011 See the whole document.	1-30
A	US 5110500 A (WALKER, JAMES K.) 05 May 1992 See the whole document.	1-30
A	US 4522742 A (LEE, DUK H. et al.) 11 June 1985 See the whole document.	1-30
A	US 4578213 A (SIMONETTI, JOHN J.) 25 March 1986 See the whole document.	1-30

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7372041 B1 (NAGARKAR, VIVEK et al.) 13 May 2008 See the whole document.	1-30
A	HAMEL, M. et al. "Fluorescent 1,8-naphthalimides-containing polymers as plastic scintillators. An attempt for neutron-gamma discrimination", Reactive and Functional Polymers, Vol. 68, No. 12, Pages 1671 - 1681, 30 September 2008 See the whole document.	1-30
A	QUARANTA, A. et al. "Optical and Scintillation Properties of Polydimethyl-Diphenylsiloxane Based Organic Scintillators", IEEE Trans. Nuclear Sci., Vol. 57, No. 2, Pages 891 - 900, 30 April 2010 See the whole document.	1-30
A	BROOKS, F. D. et al. "Pulse Shape Discrimination in a Plastic Scintillator", IRE Transaction on Nuclear Science Vol. 7, No. 2-3, Pages 35 - 38, 30 June 1960 See the whole document.	1-30

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/033449

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4127499 A	28.11.1978	JP 52-014479 A	03.02.1977
		JP 58-030912 B	02.07.1983
US 2006-0054863 A1	16.03.2006	US 7857993 B2	28.12.2010
US 5110500 A	05.05.1992	EP 0358413 A1	14.03.1990
		JP 02-225588 A	07.09.1990
US 4522742 A	11.06.1985	EP 0087639 A2	07.09.1983
		EP 0087639 A3	26.10.1983
		EP 0087639 B1	28.12.1988
		JP 03-193767 A	23.08.1991
		JP 59-000700 A	05.01.1984
US 4578213 A	25.03.1986	JP 61-034445 A	18.02.1986
		US 4578213 A	25.03.1986
		US 4713198 A	15.12.1987
US 7372041 B1	13.05.2008	None	