Understanding the behavior of different metals in loaded scintillators: discrepancy between gadolinium and bismuth

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<u>Supporting information</u>

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Experimental: radioluminescence.

Radioluminescence spectra were acquired by using the following procedure. In the Fluoromax 4P spectrofluorometer (Horiba), the excitation light was shut down. In the center of the experimenter chamber, 90Sr/90Y β-emitting source (25 MBq) was placed at 1 cm away from the scintillator to irradiate the plastic scintillator located close to the detection cell. Spectra were acquired with integration time 5 s/nm. Two types of blank spectra were recorded: one with the plastic scintillator without source and one with the source without scintillator, in order to establish a base line. Plastic scintillator EJ-200 was purchased from Eljen Technology and was used as reference set at 10,000 ph/MeV.

		1		2		3		4		5
	wt% PPO	Scintillation yields for 0 wt% Bi	wt% PPO	Scintillation yields for 1 wt% Bi	w% PPO	Scintillation yields for 2 wt% Bi	w% PPO	Scintillation yields for 5 wt% Bi	w% PPO	Scintillation yields for 10 wt% Bi
A	0.5	--	0.5	**0.55**	0.5	**0.43**	0.5	**0.25**	0.5	**0.09**
B	1	--	1	--	1	**0.61**	1	**0.30**	1	**0.14**
C	3	**0.79**	3	**0.77**	3	**0.68**	3	**0.39**	2	**0.16**
D	9	**0.90**	9	**0.84**	9	**0.73**	8	**0.49**	8	**0.21**
E	23	**1.00**	23	**0.93**	22	**0.85**	21	**0.69**	20	**0.35**

Table SI1: scintillation yields for each point on the PPO/Bi graph with a ^{137}Cs source

		1		2		3		4
	PPO wt%	Scintillation yields for 0 wt% Gd	PPO w%	Scintillation yields for 1 wt% Gd	PPO wt%	Scintillation yields for 2wt% Gd	PPO wt%	Scintillation yields 2 for wt% Gd
F	0.5	--	0.5	**0.37**	0.5	0.21	0.4	0.10
G	1	**0.89**	1	**0.60**	1	0.31	1	0.10
H	3	**0.90**	3	**0.73**	3	0.49	2	0.12
I	9	**0.97**	9	**0.69**	8	0.45	8	0.17
J	23	**1.00**	22	**0.71**	22	0.49	20	0.17

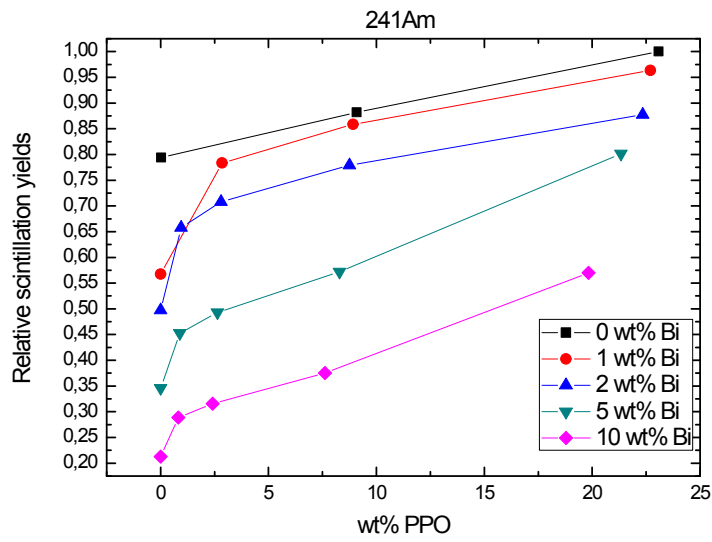Table SI2: scintillation yields for each point on the PPO/Gd graph with a ^{137}Cs source

Figure Si1: Evolution of scintillation yields with various PPO and bismuth concentration. series A to E with a [241]Am source
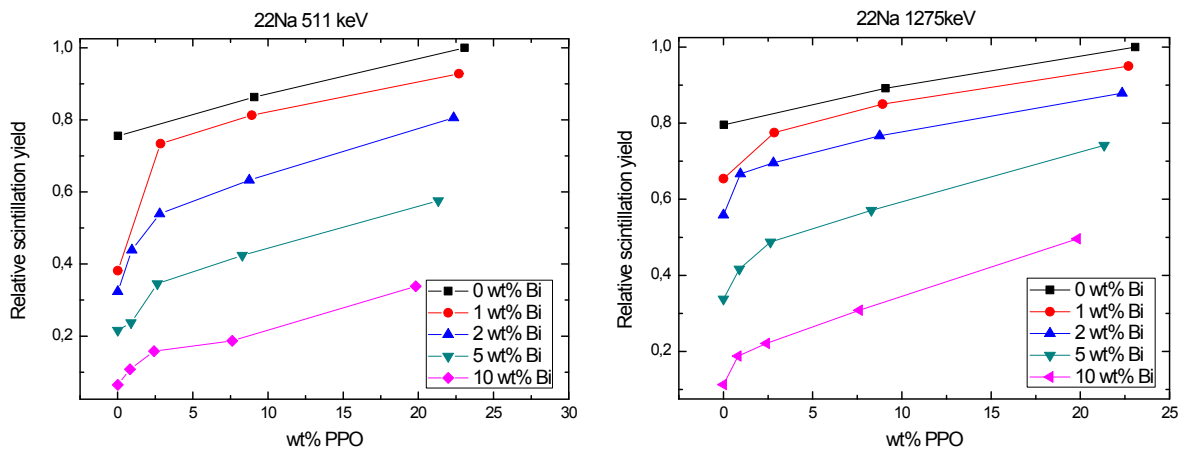

Figure Si2: Evolution of scintillation yields with various PPO and bismuth concentration. series A to E with a [22]Na source
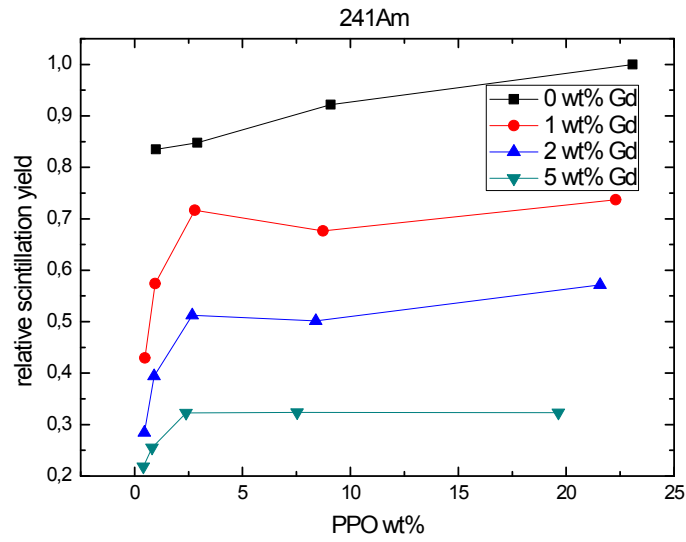
Figure Si3: Evolution of scintillation yields with various PPO and gadolinium concentration. series F to J with a [241]Am source
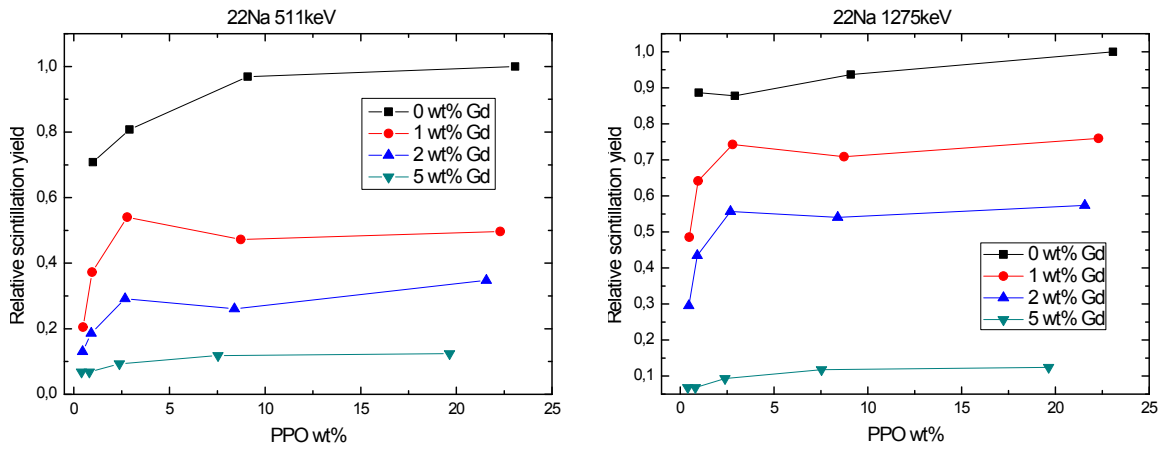

Figure SI4: Evolution of scintillation yields with various PPO and gadolinium concentration. series F to J with a [22]Na source
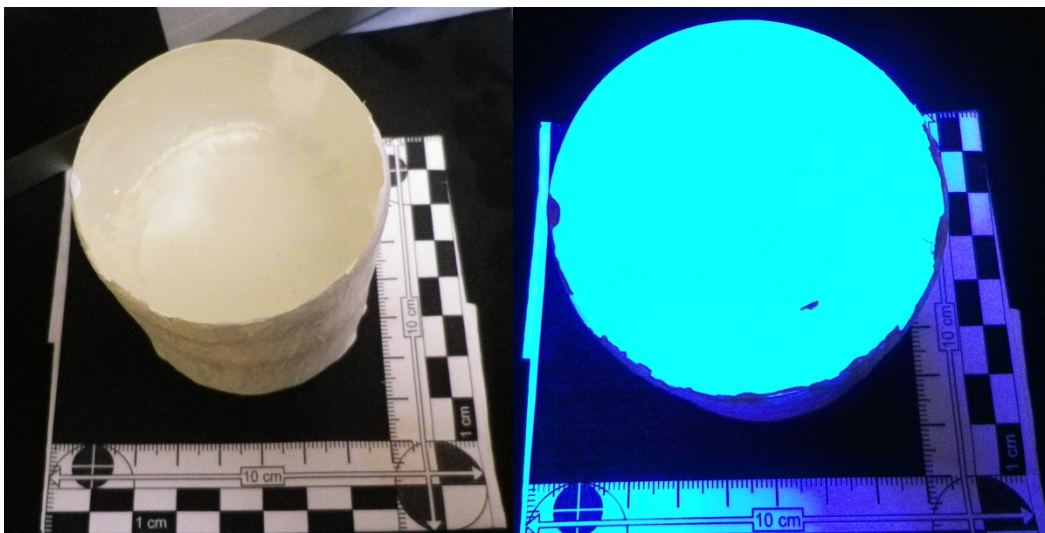
Figure SI5: left. Photo of sample K. 5 wt% bismuth loaded plastic scintillator; right UV response.
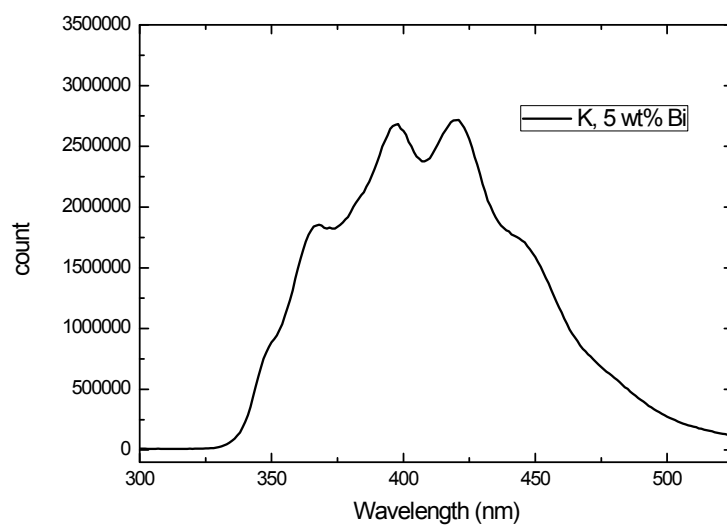

Figure SI6: emission spectra of sample K. 5 wt% bismuth loaded plastic scintillator
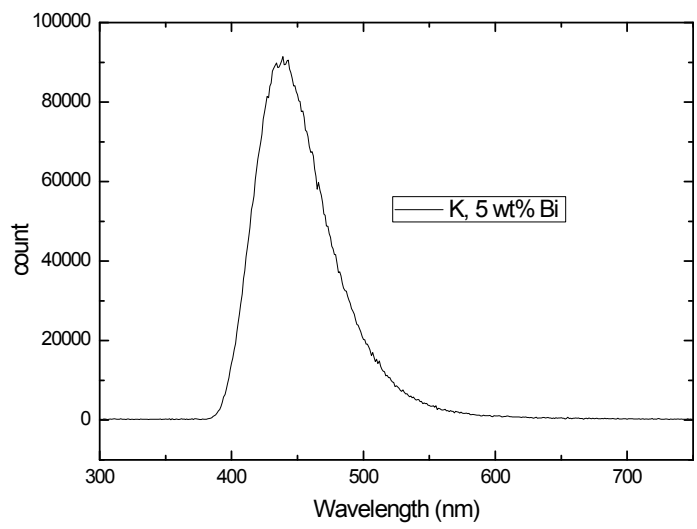
Figure SI7: radioluminescence of sample K. 5 wt% bismuth loaded plastic scintillator under beta irradiation (90Sr/90Y)
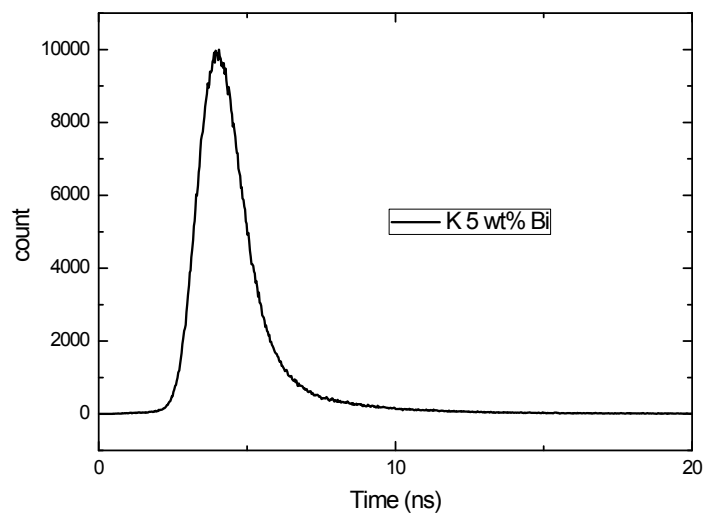
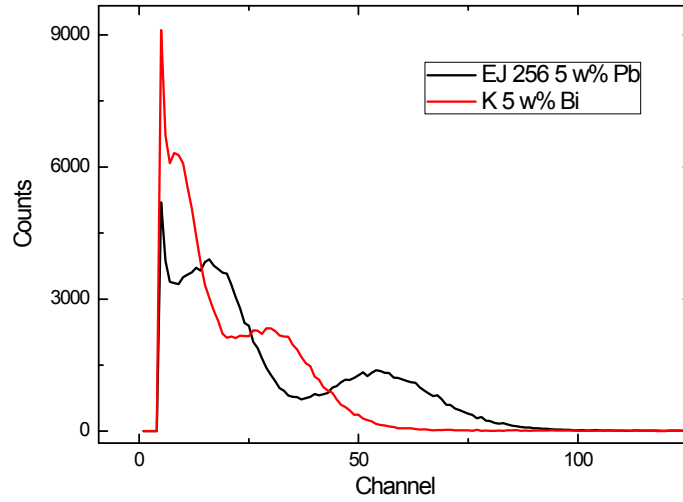Figure SI8: Mean pulse for decay time measurements of sample K. 5 wt% bismuth loaded plastic scintillator

Figure SI9: Pulse height spectra of EJ256-5 wt% lead loaded (black) and sample K. 5 wt% bismuth loaded (red) plastic scintillators with a [57]Co source
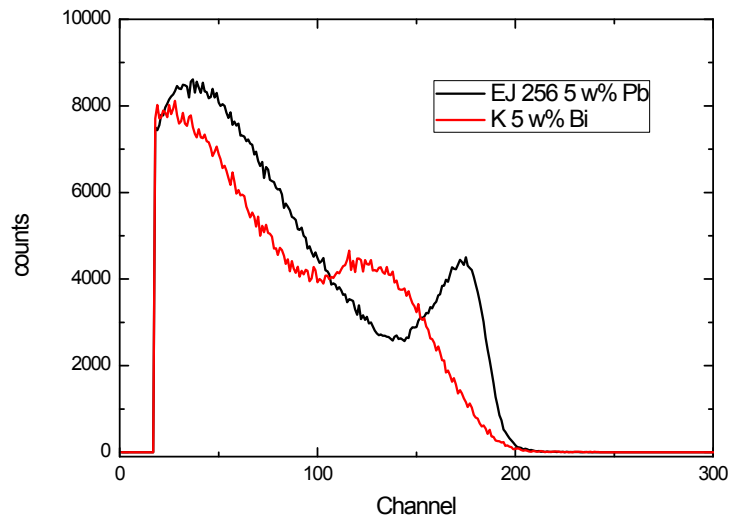
Figure SI10: Pulse height spectra of EJ256-5 wt% lead loaded (black) and sample K. 5 wt% bismuth loaded (red) plastic scintillators with a ^{137}Cs source
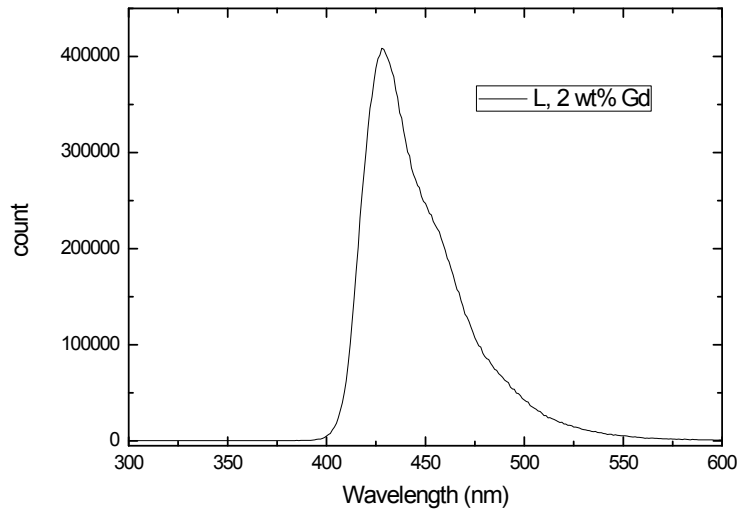

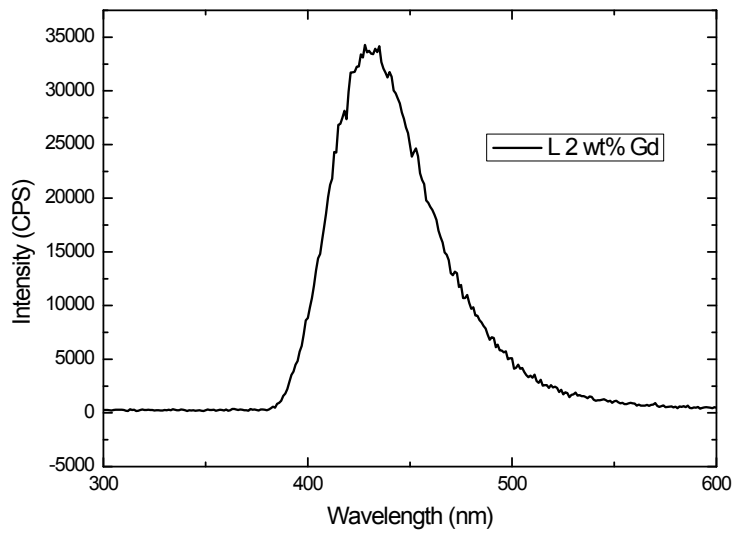Figure SI11: emission spectra of sample L. 2 wt% gadolinium loaded plastic scintillator

Figure SI12: radioluminescence of sample L. 2 wt% gadolinium loaded plastic scintillator under beta irradiation (90Sr/90Y)
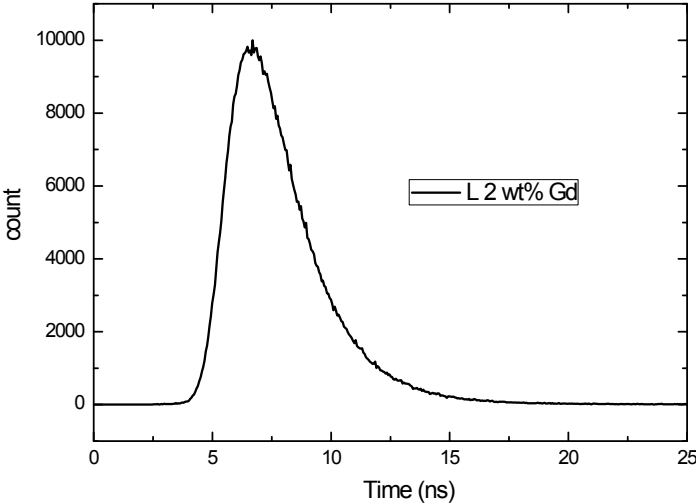

Figure SI13: Mean pulse for decay time measurements of sample L. 2 wt% gadolinium loaded plastic scintillator