Supplementary Information (SI) for RSC Advances.

Advances in Perovskite Based Scintillation Materials for Gamma ray spectroscopy: Issues and Opportunities

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Table S1: Performance metrics from ABX_3 perovskite scintillators under various ranges of gamma energy

Type	Material	Growth Method	Volume (mm^3)	Emission wavelength (nm)	Source	Light yield photons/MeV	Decay time (µs)	Resolution (%)	Year [Ref.]
ABX_3	CsEuI3	Vertical Gradient Freeze technique	50	460	137Cs (662 keV)	24,000	3.4	11	2011 [1]
	$CsSr_{0.99}Eu_{0.01}I_3$		-	446		32,000	1.7	9	
	$CsSr_{0.92}Eu_{0.08}I_3$		-	457		65,000	3.3	5.9	
	$CsSr_{0.96}Ba_{0.03}Eu_{0.01}I_3$	a vertical clamshell furnace (Melting)	50	449	137Cs (662 keV)	28,000	1.8	8	2013 [2]
	$CsSr_{0.93}Ba_{0.06}Eu_{0.01}I_3$			448		26,130	1.8	-	
	$CsSr_{0.90}Ba_{0.09}Eu_{0.01}I_3$			448		23,910	2.0	-	
	$CsSr_{0.85}Ba_{0.14}Eu_{0.01}I_3$			445		22,100	2.0	-	
	$CsSr_{0.75}Ba_{0.024}Eu_{0.01}I_3$			450		18,400	2.1	-	
	$CsSr_{0.95}Eu_{0.05}Cl_3$	BS	226	433	137Cs (662 keV)	33,400	2.7	11.5	2014 [3]
	$CsSr_{0.95}Eu_{0.05}Br_3$	BS		438		31,300	2.5	9	
	$CsSrI_3$: 0.28 % Tl	BS	-	520	137Cs (662 keV)	29,859	0.5	7.92	2023 [4]
	RbSrI3	BS	77	447	137Cs (662 keV)	8000	0.375	7.9	2024 [5]
	$CsBaBr_3$:2%Eu	BS	-	425	137Cs (662 keV)	22,000	1.193	5.5	2011 [6]
	$CsSrI_3$: 2%Eu		-	450	137Cs (662 keV)	20,000	0.700	5.5	
	$CsSrBr_3$: 2%Eu		-	431	137Cs (662 keV)	17,000	0.973		
	$CsCaCl_3$:Eu 10%	BS	32	450	137Cs (662 keV)	18,000	5.05	8.9	2012 [7]
	$CsCaI_3$:Eu 3%			450		38,500	1.72	8	
	$Cs_{0.8}Rb_{0.2}Ca_{0.95}Eu_{0.05}Br_3$	BS	-	-	137Cs (662 keV)	38.4% of NaI:Tl	4.03	10	2020 [8]
	$Cs_{0.6}Rb_{0.4}Ca_{0.95}Eu_{0.05}Br_3$	BS	-	-	137Cs (662 keV)	46.6% of NaI:Tl	3.89	9.96	
	$Cs_{0.4}Rb_{0.6}Ca_{0.95}Eu_{0.05}Br_3$	BS	-	-	137Cs (662 keV)	61.2% of NaI:Tl	4.01	14.8	
	$Cs_{0.2}Rb_{0.8}Ca_{0.95}Eu_{0.05}Br_3$	BS	-	-	137Cs (662 keV)	48.7% of NaI:Tl	3.5	6.4	
	$CsSr_{0.92}Eu_{0.08}I_3$	Vertical Gradient	-	457	137Cs (662 keV)	65,000	3.3	5.9	2011 [9]

	$CsSr_{0.99}Eu_{0.01}I_3$	Freeze	-	446	137Cs (662 keV)	32000	1.7	9	
	$CsEuI_3$		50	465	137Cs (662 keV)	24000	3.4	11	
	$Cs_{0.2}Rb_{0.8}Ca_{0.93}Eu_{0.07}Br_3$	BS	226	445	137Cs (662 keV)	33,600	3.74	8.9	2022 [10]
	$Cs_{0.2}Rb_{0.8}Ca_{0.94}Eu_{0.06}Br_3$.		226	443	137Cs (662 keV)	30600	3.69	6.9	
	$CsCa_{0.92}Eu_{0.08}Br_3$	BS	226	447	137Cs (662 keV)	28,000	6.097	9.3	2013 [11]
	$RbCaBr_3$:Eu 5%	BS	116	434	137Cs (662 keV)	37,000	2.3	7.6	2023 [12]
	$RbCaBr_3$:Eu 7%	BS	116	436	137Cs (662 keV)	43,000	2.8	4.0	
	$CsSrBr_3$: Eu5%	BS	125	430	137Cs (662 keV)	55,600	2.16	5.2	2016 [13]
	$CsSrBr_3$: Eu 5%	BS	125	437	137Cs (662 keV)	55,000		5.6	2016 [14]
	$CsCaCl_3$: 1 mol%Yb2+	Self-seeding solidification method	-	-	-	48,000	180	-	2022 [15]
	CsSrCl3: 1 mol%Yb^{2+}		-	-	-	16,000	65	-	
	$CsCaBr_3$: 1 mol%Yb^{2+}		-	-	-	120,000	390	-	
	$CsSrBr_3$: 1 mol%Yb^{2+}		-	-	-	23,000	57	-	
	$CsSrCl_3$: 0.5 mol% Ce	BS	9	365	137Cs (662 keV)	8600	0.626	7.2	2017 [16]
	$MAPbBr_{0.05}Cl_{2.95}$	ITC.	-	-	137Cs (662 keV)	18,000	0.00014	10.5	2019 [17]
	$CsPbBr_3$: Yb	BS	-	-	241Am (α-particle)	109,000 at 7 K	0.001	-	2020 [18].
	$CsPbBr_3$:1.5% Eu3+	-	-	-	X-ray Source	10,100	0.00289	-	2021 [19]
	$CsPbCl_3$: Yb^{3+}	Solution	-	-	X-ray source operating at 40 kV and 300 µA	102,000	-	-	2022 [20]
	$CsEuBr_3$	BS	-	445 and 510	137Cs (662 keV)	22 000	0.510	6.2	2022 [21]
	$Cs_3Cu_2I_5$:Tl	BS	1,571	517	137Cs (662 keV)	51 000	0.893	4.5	2020 [22]
	$Cs_3Cu_2I_5$:Tl	BS	16	500	137Cs (662 keV)	98,200	0.720	3.3	2021 [23]
	$Cs_3Cu_2I_5$:Tl	BS	-	505	137Cs (662 keV)	83000	0.828	4.8	2024 [24]

Table S2: Performance metrics from AB_2X_5 perovskite scintillators under various ranges of gamma energy

Type	Material	Method	Volume (mm^3)	Emission Wavelength (nm)	Source	Light Yield photons/MeV	Decay time (µs)	ER (%)	Year [Ref.]
AB_2X_5	$RbSr_2Br_5$	BS	154	420, 480	^{137}Cs (662 keV)	2,400	2.2	12.9	2025 [25]
	$RbSr_2I_5$		154	403, 441, 510	^{137}Cs (662 keV)	14,000	1.9	7.9	
	$CsBa_2Br_5$:Eu2 %	-	-	-	-	91,800	1.26	-	2011[26]
	$CsBa_2I_5$	BS	40	400,600	^{137}Cs (662 keV)	22,000	-	9.6	2014 [27]
	$RbBa_2I_5$:3%Eu_{2+}	BS	-	-	^{137}Cs (662 keV)	58,200	0.800	-	2020 [28]
	$CsBa_2I_5$:Eu4%	BS	10	435, 466	^{241}Am (18 keV)	2,600	-	16.7	2011 [29]
			-	-	^{241}Am (21keV)	3,100	-	21.3	
			-	-	^{241}Am(26.5keV)	4,100	-	17.5	
			-	-	^{241}Am(32keV)	4,750	-	13.1	
			-	-	^{137}Cs (662 keV)	1,00,000	-	2.6	
Other	$TlSr_2Br_5$	BS	-	-	^{137}Cs (662 keV)	37,600	0.390	4.6	2017 [30]
	$TlSr_2I_5$	BS	-	-	^{137}Cs (662 keV)	31,000	0.605	8.5	2018 [31]
	$TlSr_2I_5$: Eu 3%	-	-	-	-	70,000	0.525	4.2	
	$TlSr_2Cl_5$	Self-seeding solidification	-	-	^{137}Cs (662 keV)	19,000	0.0075	-	2020 [32]

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Table S3: R&D of few promising perovskite scintillators with performance metrics

Type	Material	Growth Method	Volume (mm^3)	Emission Wavelength (nm)	Source	Light yield photons/MeV	Decay time (µs)	ER(%)	Year [Ref.]
	Tl_2LaBr_5	BS	101	435	^{137}Cs (662 keV)	16000	0.084	8.1	2017 [33]
	Tl_2LaBr_5: Ce 5%		101	415		43,000	0.025	6.3	
	Cs_2HfCl_6:1%Te	BS	4	575	^{137}Cs (662 keV)	11,700	2.370	-	2018 [34]
	Cs_2HfCl_6:3%Te		4	575		13,100	2.340	-	
	Cs_2HfCl_6:5%Te		4	575		9600	2.394	-	
	Cs_2HfCl_6:10%Te		4	575		9000	2.297	-	
	Cs_2HfCl_6	BS	343	-	-	30,000	3.9	3.3	2018 [35]
	$Cs_2HfCl_4Br_2$		1,021	-	-	18,600	2	4.4	
	Cs_2HfCl_6	BS	12,462	-	^{137}Cs (662 keV)	23,000	3.8	3.5	2020 [36]
	$Cs_2HfCl_4Br_2$		10,800	-		20,000	1.8	3.7	
	Cs_2HfCl_6	BS	-	-	^{137}Cs (662 keV)	27,000	3.3	2.8	2020 [37]
	Tl_2LaCl_5:Ce 3%	BS	~48	383	^{137}Cs (662 keV)	76,000	0.036	3.4	2017 [38]
	Tl_2GdCl_5:Ce 5%	BS	80	389	^{137}Cs (662 keV)	53,000	0.032	5	2018 [39]
	Tl_2HfCl_6	BS	2	465	^{137}Cs (662 keV)	24200	6.340	17.7	2018 [40]
	Tl2ZrCl6		2	465		50800	2.360	5.6	
	Cs_2HfCl_6	BS	650	400	^{137}Cs (662 keV)	54,000	4.37	3.3	2015 [41]
	Tl_2ZrCl_6	BS	-	-	^{137}Cs (662 keV)	61300	-	5.6	2020 [42]
	$TlMgCl_3$		-	-		46000	-	7	
	$TlCdCl_3$		-	-		5900	-	17	
	$TlSrCl_3$		-	-		21300	-	10	
	$TlBaCl_3$		-	-		~ 1000	-	-	
	$TlSr_2Br_5$	BS	~180	441	^{137}Cs (662 keV)	37,600	0.390	4.6	2017 [30]
	$TlSr_2I_5$	BS	80	528	^{137}Cs (662 keV)	31,000	0.605	8.5	2018 [31]
	$TlSr_2I_5$: Eu 3%		80	463		70,000	0.525	4.2	
	Cs_2HfBr_6	BS	14	435 , 525	^{137}Cs (662 keV)	61,500	1.1	-	2018 [43]
	Cs_2ZrBr_6		6	530		37,200	4.6	-	
	Rb_2HfCl_6: Zr 0.6%		-	434	-	24,100	0.840	-	2016 [44]
	$TlSr_2Cl_5$	self-seeding solidification method	-	-	^{137}Cs (662 keV)	19,000	0.0075	-	2020 [32]
	Cs_3CeCl_6	BS	18	400	^{137}Cs (662 keV)	19,000	0.050	7.5	2011 [45]
	$CsCe_2Cl_7$		18	385		26,000	0.050	8.4	
	Tl_2ZrCl_6	BS	96	460	^{137}Cs (662 keV)	47,000	2.7	4.3	2018 [46]
	Rb_2CeCl_5	BS	-	370	^{137}Cs (662 keV)	36000	0.024	15	2019 [47]
	$LiGdCl_4$: Ce 20%	Solid state reaction	-	345 , 365	-	64,600	~0.050	-	2009 [48]
	$NaGdCl_4$: Ce 20%		-	350 , 370	-	39,4000	~1.000	-	

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