

Section 8:
Commercial Phosphors and Scintillators

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COMMERCIAL PHOSPHORS AND SCINTILLATORS

Commercial phosphors and scintillators are arranged in order of increasing wavelength in Table 1. The data were compiled for recent producers' data sheets and literature. Note that these may not be the only phosphors and scintillators available commercially or the materials still may not be manufactured.

Many phosphors are specified by P numbers assigned by the Electronics Industries Association of the United States; these have been used since 1945 and are included in Table 1. The World Phosphor Type Designation System (WPTDS), established in 1982, is a more detailed, unified phosphor system designation system. It usually consisting of two letters: the first letter indicating the criterion for the phosphor screen emission color, the second letter indicating differences from the criterion. These symbols, together with other numbers and symbols used in Japan and Europe, are included in an extensive tabulation by Inaho and Hase in chapter 6—Section 6 of the *Phosphor Handbook*.

Table 1 Commercial phosphors and scintillators

Wavelength of maximum emission (nm)	Chemical formula	Designation or acronym
220, 310 ⁽¹⁾	BaF ₂ ^(1,2)	
305	CeF ₃ ⁽²⁾	
307	MgSrAl ₁₀ O ₁₇ :Ce	
315	CsI ⁽²⁾	
330–352	LaCl ₃ :Ce ³⁺⁽²⁾	
338	(CeMg)SrAl ₁₁ O ₁₈ :Ce	
342–347	(CeMg)BaAl ₁₁ O ₁₈ :Ce	
350	YAlO ₃ :Ce ³⁺⁽²⁾	YAP, YALO
351	BaSi ₂ O ₅ :Pb	
358–385	LaBr ₃ :Ce ³⁺⁽²⁾	
365	LuAlO ₃ :Ce ³⁺⁽²⁾	LuAP
371	SrB ₄ O ₇ :Eu	
380	Lu ₂ Si ₂ O ₇ :Ce ³⁺⁽²⁾	LPS
385	Ca ₂ MgSi ₂ O ₇ :Ce ³⁺	P16
390	CsF ^(1,2)	
390	ZnO:Ga	
400	Y ₂ SiO ₅ :Ce ³⁺	P47
400	Zn ₂ SiO ₄ :Ti	P52
400, 525	P46 (70%) + P47 (30%)	P48
410	Y ₂ SiO ₅ :Ce ³⁺⁽²⁾	YSO:Ce

Table 1 Commerical phosphors and scintillators—*continued*

Wavelength of maximum emission (nm)	Chemical formula	Designation or acronym
410	YTaO ₄ :Nb	
415	Lu _{1-x} Y _x AlO ₃ :Ce ³⁺⁽²⁾	LuYAP
415	NaI:Ti ⁽²⁾	
418–420	—	MSL
420	CsI:Na ⁺⁽²⁾	
420	CaWO ₄ ⁽²⁾	CWO
420	CaWO ₄ :W	P5
420	Lu ₂ SiO ₅ :Ce ³⁺	LSO
420	Sr ₂ P ₂ O ₇ :Eu	
425–430	(Lu,Gd) ₂ SiO ₅ :Ce ³⁺	LGSO
433	CaWO ₄ :Pb	
435	CaF ₂ :Eu ²⁺⁽²⁾	
440	Gd ₂ SiO ₅ : Ce ³⁺⁽²⁾	GSO
447	Sr ₅ Cl(PO ₄) ₃ :Eu	
450	BaMgAl ₁₀ O ₁₇ :Eu	BAM
455–504	ZnS:Cu	
456, 514	BaMgAl ₁₀ O ₁₇ :Eu:Mn	BAM:Eu,Mn
460	Sr ₂ P ₂ O ₇ :Sn	
460	ZnS:Ag,Cl	P11*
465	ZnS:Ag,Ni	P37
470/540	CdWO ₄ ⁽²⁾	CWO
473	MgWO ₄	
480	ZnWO ₄ ⁽²⁾	
480	Bi ₄ Ge ₃ O ₁₂ ⁽²⁾	BGO
480	Sr ₆ P ₅ BO ₂₀ :Eu	
482	Ca ₅ (PO ₄) ₃ F:Sb	
494	(Ba,Ti) ₂ P ₂ O ₇ :Ti	
504	ZnO:Zn	P15
509	Sr ₅ (PO ₄) ₃ F:Sb,Mn	
510	Gd ₂ O ₂ S:Pr ⁽³⁾	UFC
510	Gd ₂ O ₂ S:Pr,Ce,F ⁽³⁾	
510	ZnO:Zn	P24
513	Y ₂ O ₂ S:Pr ³⁺	
520	ZnS:Cu,Cl	P31
525	CdS:In	
525	Zn ₂ SiO ₄ :Mn,As	P39

Table 1 Commercial phosphors and scintillators—*continued*

Wavelength of maximum emission (nm)	Chemical formula	Designation or acronym
525	$\text{Zn}_2\text{SiO}_4:\text{Mn}^{2+}$	P1
526	$\text{Zn}_2\text{SiO}_4:\text{Mn}^{2+}$	ZSM
528	$\text{Zn}_2\text{SiO}_4:\text{Mn};\text{Sb}_2\text{O}_3$	
530	$\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}^{3+(2)}$	P46
540	$\text{ZnS}:\text{Pb},\text{Cu}$	P34
543	$\text{ZnS}:\text{Ag},\text{Cu},\text{Cl}$	P2
544	$\text{Gd}_2\text{O}_2\text{S}:\text{Tb}^{3+}$	P43, GOS
544	$\text{La}_2\text{O}_2\text{S}:\text{Tb}^{3+}$	P44
544	$\text{Y}_2\text{O}_2\text{S}:\text{Tb}^{3+}$	P45
544	$\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Tb}^{3+}$	P53
546	$(\text{Ce},\text{Tb})\text{MgAl}_{11}\text{O}_{19}:\text{Ce}:\text{Tb}$	
546	$(\text{La},\text{Ce},\text{Tb})\text{PO}_4:\text{Ce}:\text{Tb}$	
550	$(\text{Zn},\text{Cd})\text{S}:\text{Cu}$	P28
550	$\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}^{3+(2)}$	YAG:Ce
559	$\text{MgF}_2:\text{Mn}^{2+}$	P33
560	$(\text{Zn},\text{Cd})\text{S}:\text{Ag},\text{Cl}$	P20
560	$\text{CsI}:\text{Tl}^{(2)}$	
560	$\text{Zn}_{0.6}\text{Cd}_{0.4}\text{S}:\text{Ag}$	
584	$\text{ZnS}:\text{Mn},\text{Cu}$	
585	$\text{KMgF}_3:\text{Mn}^{2+}$	P26
590	$(\text{Zn},\text{Mg})\text{F}_2:\text{Mn}^{2+}$	P12
590	$\text{KMgF}_3:\text{Mn}^{2+}$	P19
593, 611	$(\text{Y},\text{Gd})\text{BO}_3:\text{Eu}^{3+}$	
593, 619, 696	$\text{Y}(\text{P},\text{V})\text{O}_4:\text{Eu}^{3+}$	
600	$(\text{Zn},\text{Mg})\text{F}_2:\text{Mn}^{2+}$	P38
605	$\text{MgF}_2:\text{Mn}^{2+}$	P21
610	$(\text{Ca},\text{Zn},\text{Mg})_3(\text{PO}_4)_2:\text{Sn}$	
610	$(\text{Y},\text{Gd})_2\text{O}_3:\text{Eu}^{3+(2,3)}$	
610	$\text{CaSiO}_3:\text{Mn}^{2+},\text{Pb}$	P25
610	$\text{Y}_{1.34}\text{Gd}_{0.60}\text{O}_3(\text{Eu},\text{Pr})_{0.06}^{(3)}$	Hilight™
610	$\text{Y}_{1.34}\text{Gd}_{0.60}\text{O}_3(\text{Eu},\text{Pr})_{0.06}$	YGO
611	$\text{Y}_2\text{O}_3:\text{Eu}^{3+}$	P56, YOE
619	$\text{YVO}_4:\text{Eu}^{3+}$	P49*, YVE
626	$(\text{Sr},\text{Mg})_3(\text{PO}_4)_2:\text{Sn}$	
626	$\text{Y}_2\text{O}_2\text{S}:\text{Eu}^{3+}$	P54*
627	$(\text{Sr},\text{Mg})_3(\text{PO}_4)_2:\text{Sn}$	

Table 1 Commercial phosphors and scintillators—*continued*

Wavelength of maximum emission (nm)	Chemical formula	Designation or acronym
627	Gd ₂ O ₂ S:Eu ³⁺	
630	Zn _{0.4} Cd _{0.6} S:Ag	
635	Zn ₃ (PO ₄) ₂ :Mn ²⁺	P27
640	MgSiO ₃ :Mn ²⁺	P13
658	Mg ₄ (F)(Ge,Sn)O ₆ :Mn ²⁺	
658	Mg ₄ (F)GeO ₆ :Mn ²⁺	
730	Gd ₃ Ga ₅ O ₁₂ :Cr,Ce ⁽²⁾	GGG:Cr

* These compositions are also sometimes designated as P22. P22 can be any of several compounds.

- (1) Core-valence luminescence
- (2) Single crystal scintillator
- (3) Transparent ceramic