Phosphors for Cathode-Ray Tubes (CRTs)

Application in monitors, oscilloscopes, radar screens and TV sets

CRT phosphors are specific chemical compounds, which are luminescent and are arranged on the inside of the TV tube in a certain order and are available in various colors, starting with basic red, green and blue for color CRTs, with precise grain size control, dispersion control and surface treatment to match exact tube specifications. Upon excited by a scanning electron beam in the CRT, the phosphors will glow momentarily until refreshed again (many times per second) forming a picture composed of colors by utilizing the red, green and blue combinations. If you look at your TV screen (while it is turned on) with a magnifying glass, you can see the colored elements. Over many years of use, the phosphors will gradually fade in brilliance and the color of your TV screen will lose its original richness.

Chemical composition of most important CRT TV phosphors

Red Phosphor Y_2O_2S:Eu
Green Phosphor ZnS:Cu,Al,Au
Blue Phosphor ZnS:Ag

Category	Color (JEDEC RMA Number)	Chemical Composition
Color CRT	Blue (P-22B)	ZnS:Ag
	Blue (P-22B)	ZnS:Ag + Pigment
	Green (P-22G)	ZnS:Cu,Al
	Green (P-22G)	ZnS:Cu,Au,Al
	Red (P-22R)	Y_2O_2S:Eu
	Red (P-22R)	Y_2O_2S:Eu + Pigment

Other applications of those phosphors such as listed below

Category	Color	Chemical Composition
EL Panels	Blue-Green	ZnS:Cu
	Green	ZnS:Cu
	Orange	ZnS:Cu,Mn
X-Ray Intensifying Screens	Green	Gd_2O_2S:Tb
Printing	Blue	ZnS:Ag
	Green	ZnS:Cu
	Orange	ZnS:Mn

CRT Phosphors from Nichia

P22 Color - EIA Registered

NP #	Composition	WTDS/EIA	S.G.	Emission Peak (nm)/Color	Decay (1/10)	Notes
NP-2111	ZnS:Ag,Cl (non-pigmented)	X/P22	4.07	450 Blue	MS	-
NP-2112	ZnS:Ag,Cl (pigmented)	X/P22	4.07	450 Blue	MS	-
NP-2121	ZnS:Ag,Al (non-pigmented)	X/P22	4.07	450 Blue	MS	-
NP-2122	ZnS:Ag,Al (pigmented)	X/P22	4.07	450 Blue	MS	-
NP-	ZnS:Cu,Al	X/P22,DB/P54	4.10	530 Green	MS	Cu

2211						Green
NP-2221	ZnS:Cu,Au,Al	X/P22	4.10	535 Green	MS	Au Green
NP-2311	Y_2O_2S:Eu (non-pigmented)	X/P22,DB/P54	4.95	626 Red	M	-
NP-2312	Y_2O_2S:Eu (pigmented)	X/P22	4.95	626 Red	M	-

CRT Phosphors - EIA Registered

NP #	Composition	WTDS/EIA	S.G.	Emission Peak (nm)/Color	Decay (1/10)	Notes
NP-1001	Zn_2SiO_4:Mn	GJ/P1	4.13	525	M	Display Tubes
NP-1004	ZnS:Ag + (Zn,Cd)S:Cu	WW/P4	-	White	MS	B&W Tubes, Display Tubes
NP-1011	ZnS:Ag,Cl or ZnS:(Zn)	BE/P11	4.07	460	MS	Display Tubes, Vacuum Fluorescent Display
NP-1019	(KF,MgF_2):Mn	LF/P19	3.14	590	L	Radar Screen
NP-1020	(Zn,Cd)S:Ag or (Zn,Cd)S:Cu	KA/P20	4.13	Yellow	M	Display Tubes
NP-1024	ZnO:Zn	GE/P24	5.60	505	S	Vacuum Fluorescent Display
NP-1026	(KF,MgF_2):Mn	LC/P26	3.14	595	VL	Radar Screen

NP-1028	(Zn,Cd)S:Cu,Cl	KE/P28	-	Yellow	M	Display Tubes
NP-1031	ZnS:Cu or ZnS:Cu,Ag	GH/P31	4.10	Yellowish-Green	MS	Oscilloscopes for Printing
NP-1033	MgF_2:Mn	LD/P33	3.14	590	VL	Radar Screen
NP-1038	$(Zn,Mg)F_2$:Mn	LK/P38	3.14	590	VL	Radar Screen
NP-1039	Zn_2SiO_4:Mn,As	GR/P39	4.20	525	L	Display Tubes
NP-1040	ZnS:Ag + (Zn,Cd)S:Cu	GA/P40	-	White	L	Display Tubes
NP-1043	Gd_2O_2S:Tb	GY/P43	7.50	545	M	Display Tubes
NP-1045	Y_2O_2S:Tb	WB/P45	4.95	545 White	M	View Finder
NP-1045	Y_2O_2S:Tb	-	4.95	545 Green	M	Display Tubes
NP-1046	$Y_3Al_5O_{12}$:Ce	KG/P46	4.15	530	VS	Beam Index Tubes
NP-1046 A	$Y_3(Al,Ga)_5O_{12}$:Ce	-	4.96	520	VS	Beam Index Tubes
NP-1047	Y_2SiO_5:Ce	BH/P47	4.36	400	VS	Beam Index Tubes
NP-1053	$Y_3Al_5O_{12}$:Tb	KJ/P53	4.74	544	M	Projection Tubes
NP-1053 A	$Y_3(Al,Ga)_5O_{12}$:Tb	-	5.15	544	M	Projection Tubes

NP-1055	ZnS:Ag,Al	BM/P55	4.07	450	MS	Projection Tubes
NP-1056	Y_2O_3:Eu	X/P22,RF/P56	5.05	611	M	Projection Tubes

CRT Phosphors - Others

NP #	Composition	S.G.	Emission Peak (nm)/Color	Decay (1/10)	Notes
NP-1101	$InBO_3$:Tb	5.47	550	M	-
NP-1102	$InBO_3$:Eu	5.47	588	M	-
NP-1104	ZnS:Ag	4.07	450	MS	-
NP-1108	ZnS:Cu,Al or ZnS:Cu,Au,Al	4.07	530	MS	-
NP-1109	ZnS:Ag	-	450	MS	-
NP-1150	Y_2SiO_5:Tb	4.43	545	M	Projection Tubes
NP-1201	(Zn,Cd)S:Cu,Cl + (Zn,Cd)S:Ag,Cl	-	White	M	-
NP-1291	$InBO_3$:Tb + $InBO_3$:Eu	-	Amber	M	-
NP-1305	ZnS:Ag + ZnS:Cu(or ZnS:Cu,Au) + $Y_2)_2S$:Eu	-	White	M	Cd free P4, B&W Tubes, Display Tubes
NP-	$InBO_3$:Tb + $InBO_3$:Eu + ZnS:Ag	-	White	M	-

Phosphors for Cathode Ray Tubes		
TEPAC-WW	**Chemical Composition**	**MEDIAN PARTICLE SIZE (µm)**
P1-GK	Zn_2SiO_4:Mn	8.0
P1-GK	Zn_2SiO_4:Mn	3.0
P5-BJ	$CaWO_4$	8.0
P7-YX	(Zn,Cd)S:Cu	12.0
P11-BE	ZnS:Ag	6.5
P11-BE	ZnS:Ag	3.0
P15-GG	ZnO:Zn	4.0
P19-LF	$KMgF_3$:Mn	8.0
P20-KA	(Zn,Cd)S:Ag	8.0
P20-KA	(Zn,Cd)S:Ag	3.5
P20-KA	(Zn,Cd)S:Ag	2.1
P22-X (R)	Y_2O_2S:Eu	7.5
P22-X (R)	YVO_4:Eu	5.0
P22-X (G)	ZnS:Cu,Au,Al	8.0
P22-X (B)	ZnS:Ag	8.0
P25-LJ	$CaSiO_3$:Mn,Pb	8.0
P26-LC	$KMgF_3$:Mn	8.0
P31-GH	ZnS:Cu	10.0

P33-LD	MgF_2:Mn	9.0
P38-LK	$(Zn,Mg)F_2$:Mn	8.5
P39-GR	Zn_2SiO_4:Mn, As	7.5
P39-GR	Zn_2SiO_4:Mn, In	6.0
P43-GY	Gd_2O_2S:Tb	8.5
P43-GY	Gd_2O_2S:Tb	3.5
P43-GY	Gd_2O_2S:Tb	2.5
P44-GX	La_2O_2S:Tb	7.0
P45-WB	Y_2O_2S:Tb	7.5
P45-WB	Y_2O_2S:Tb	3.5
P45-RED-ENH	Y_2O_2S:Tb,Eu	5.0
P45-RED-ENH	Y_2O_2S:Tb,Eu	3.5
P45-RED-ENH	Y_2O_2S:Tb,Eu	2.5
P46-KG	$Y_3Al_5O_{12}$:Ce	6.0
P46-KG	$Y_3Al_5O_{12}$:Ce	3.0
P46(Ga)	$Y_3(Al,Ga)_5O_{12}$:Ce	5.7
P46(Ga)	$Y_3(Al,Ga)_5O_{12}$:Ce	2.5
P47-BH	Y_2SiO_5:Ce	6.5
P47-BH	Y_2SiO_5:Ce	3.0
P47-BH	Y_2SiO_5:Ce	2.0
P48-KH	(P46+P47 Blend)	6.0
P53(Ga)	$Y_3(Al,Ga)_5O_{12}$:Tb	8.5
P53(Ga)	$Y_3(Al,Ga)_5O_{12}$:Tb	3.5

P53(Ga)	$Y_3(Al,Ga)_5O_{12}$:Tb	2.5
P56-RF	Y_2O_3:Eu	6.0
P56-RF	Y_2O_3:Eu	3.5