Persistent Luminescence (Afterglow) Phosphors

Eu^{2+} activated aluminates					
Host matrix	**Emission center**	**Co-dopant**	**Emission wavelength [nm]**	**Afterglow duration**	**References**
$MgAl_2O_4$	Eu^{2+}	Dy^{3+}	480	>1 min	[1,2]
$CaAl_2O_4$	Eu^{2+}	Nd^{3+}	440	>5 h	[3-6]
$Ca_{12}Al_{14}O_{33}$	Eu^{2+}	Nd^{3+}	440	>5 min	[7]
$SrAl_{12}O_{19}$	Eu^{2+}	Dy^{3+}	400	>2 h	[8-10]
$SrAl_4O_7$	Eu^{2+}	Dy^{3+}	480	>1 h	[8,11-12]
$Sr_4Al_{14}O_{25}$	Eu^{2+}	Dy^{3+}	405, 490	>10 h	[13-16]
$SrAl_2O_4$	Eu^{2+}	Dy^{3+}	445, 520	>10 h	[17-20]
$Sr_3Al_2O_6$	Eu^{2+}	Dy^{3+}	535,620	>10 min	[8, 21 -24]
$BaAl_2O_4$	Eu^{2+}	Dy^{3+}	505	>2 h	[25-27]
$SrMgAl_{10}O_{17}$	Eu^{2+}	Dy^{3+}	460, 515	>3 min	[28]
$BaMgAl_{10}O_{17}$	Eu^{2+}	Co^{3+}	450	>5 min	[29]
$BaCa_2Al_8O_{15}$	Eu^{2+}	Dy^{3+}	435	>5 min	[30]

Eu^{2+} activated silicates					
Host lattice	**Emission center**	**Co-dopant**	**Emission wavelength [nm]**	**Afterglow duration**	**References**
$CaMgSi_2O_6$	Eu^{2+}	Dy^{3+}, Nd^{3+}	447	>4 h	[31-33]
$Ca_2MgSi_2O_7$	Eu^{2+}	Tb^{3+}	545	>5 h	[31, 34-36]
$Ca_3MgSi_2O_8$	Eu^{2+}	Dy^{3+}	470	>6 h	[37-38]
$CaAl_2Si_2O_8$	Eu^{2+}	Dy^{3+}/Pr^{3+}	440	>2 h	[39-41]
Sr_2SiO_4	Eu^{2+}	Dy^{3+}	470, 560	>10 min	[42-43]
$Sr_2MgSi_2O_7$	Eu^{2+}	Dy^{3+}	470	>10 h	[44-47]
$Sr_3MgSi_2O_8$	Eu^{2+}	Dy^{3+}	460	>7 h	[38,48]
$Sr_2Al_2SiO_7$	Eu^{2+}	Dy^{3+}	484	>1min	[49]
$Sr_3Al_{10}SiO_{20}$	Eu^{2+}	Ho^{3+}	466	>6 h	[50-51]
$Ba_{13}Al_{22}Si_{10}O_{66}$	Eu^{2+}	-	426, 471, 543	>40 min	[52]
$Ba_2MgSi_2O_7$	Eu^{2+}	Tm^{3+}	505	>5 h	[53-54]
$Ba_3MgSi_2O_8$	Eu^{2+}	Dy^{3+}	440	>20 min	[38]
$Ba_4Si_6O_{16}$	Eu^{2+}	Dy^{3+}	506	>24 h	[55]
$CaSrAl_2SiO_7$	Eu^{2+}	-	444	>20 min	[41]
$Ca_2ZnSi_2O_7$	Eu^{2+}	-	528	>2h	[56]
$Sr_2ZnSi_2O_7$	Eu^{2+}	Dy^{3+}	457	>3 min	[57-58]
$Ba_2ZnSi_2O_7$	Eu^{2+}	Nd^{3+}	505	>1 min	[59]

Other Eu^{2+} activated phosphors					
Host lattice	**Emission center**	**Co-dopant**	**Emission wavelength [nm]**	**Afterglow duration**	**References**
$Ca_2Si_5N_8$	Eu^{2+}	Tm^{3+}	610	>1 h	[60-63]
$CaAl_2B_2O_7$	Eu^{2+}	Nd^{3+}	464	>1 h	[64]
$SrAl_{1.7}B_{0.3}O_4$	Eu^{2+}	-	520	2	[65]
$Ca_2P_2O_7$	$Eu^{2+,}$	Y^{3+}	415	>6 h	[66]
$Sr_2P_2O_7$	Eu^{2+}	Y^{3+}	420	>8 h	[67]
$SrMg_2P_2O_8$	Eu^{2+}	Ce^{3+} /Gd^{3+}	400	>2 h	[68]
CaS	Eu^{2+}	Tm^{3+}	650	>1 h	[69-70]
$CaGa_2S_4$	Eu^{2+}	Ho^{3+}	555	>30 min	[71-72]
Ca_2SiS_4	Eu^{2+}	Nd^{3+}	660	>30 min	[73]

[1] A.S. Maia, R. Stefani, C.A. Kodira, M.C.F.C. Felinto, E.E.S. Teotonio, H.F. Brito Opt. Mater. 31 (2008) 440-444

[2] X. Xu, Y. Wang, Y. Gong, Y. Li, J. Nanosci. Nanotechnol. 11 (2011) 9851-9854

[3] T. Katsumata, T. Nabae, K. Sasajima, T. Matsuzawa J. Cryst. Growth 183 (1998) 361–365

[4] J. Hölsä, H. Jungner, M. Lastusaari, J. Niittykoski, J. Alloy. Compd. Vol. 323–324 (2001) 326-330

[5] Y. Lin, Z. Tang, Z. Zhang, C. Nan, J. Eur. Ceram. Soc. 23 (2003) 175-178

[6] H. Ryu, K.S. Bartwal J. Alloys & Compd. 476 (2009) 379-382

[7] J. Zhang, Z. Zhang, T. Wang, W. Hao Mater. Lett. 57 (2003) 4315-4318

[8] T. Katsumata, K. Sasajima, T. Nabae, S. Komuro, T. Morikawa, J. Am. Ceram. Soc. 81 (1998) 413–416

[9] T. Katsumata, Y. Kohno, H. Kubo, S. Komuro, T. Morikawa Rev. Sci. Instrum. 76 (2005) 084901-1

[10] D.-L. Xian, K.-L. Huang, Z.-J. Li Chin. J. Lumin. 123 (2007) 397-401

[11] Ch. Chang, D. Mao, J. Shen, Ch. J. Alloys & Compd. 348 (2003) 224–230

[12] K.R.S. Preethi, C.H. Lu, J. Thirumalai, R. Jagannathan, T.S. Natarajan, N.U. Nayak, I. Radhakrishna, M. Jayachandran, D.C. Trivedi J. Phys. D-Appl. Phys 37 (2004) 2664–2669

[13] Y. Lin, Z. Zhang, Z. Tang, J. Zhang, Z. Zheng, X. Lu, Mater. Chem. Phys. 70 (2001) 156–159

[14] Y. Lin, Z. Tang, Z. Zhang, C.W. Nan, Appl. Phys. Lett. 81 (2002) 999-998

[15] Z.-X. Yuan, C.-H. Changa, D.-L. Maoa, W. Ying J. Alloys and Compd. 377 (2004) 268–271

[16] E. Nakazawa, Y.Murazaki, S. Saito J. Appl. Phys. 100 (2006) 113113

[17] T. Matsuzawa, Y. Aoki, N. Takeuchi, Y. Murayama J. Electrochem. Soc. 143 (1996) 2670-2673

[18] T. Katsumata, T. Nabae, K. Sasajima, S. Komuro, T. Morikawa. Electrochem. Soc., 144 (1997) L243-L245
[19] J. Geng, Z. Wu J. Mater. Synth. Process.Vol. 10, No. 5 (2002) 245-248
[20] Y.Kamiyanagi, M. Kitaura, M. Kaneyoshi J. Lumin. 122–123 (2007) 509-511
[21] P. Zhang, M. Xu, Z. Zheng, B. Sun, Y. Zhang, Mater. Sci. Eng. B Solid State Mater. Adv. Technol. 136 (2007) 159–164
[22] P. Zhang, L. Lingxia, T. Yuming Physica B 404 (2009) 4286–4289
[23] P. Huang, C. Cui, S. Wang Opt. Mater. 32 (2009) 184–189
[24] C. Chang, W. Li, X. Huang, Z. Wang, X. Chen, X. Qian, R. Guo, Y. Ding, D. Mao J. Lumin 130 (2010) 347–350
[25] R. Sakai, T. Katsumata S. Komuro, T. Morikawa. J. Lumin. 85 (1999) 149–154.
[26] Y. Lin, Z. Zhang, Z. Tang, J. Zhang, Z. Zheng, X. Lu Mater. Chem. Phys. 70 (2001) 156–159
[27] L.C.V. Rodrigues, R. Stefani, H.F. Brito, M.C.F.C. Felinto, J. Hölsä, M. Lastusaari, T. Laamanen, M. Malkamäki J. Solid State Chem. Volume 183, Issue 10, (2010) 2365–2371
[28] T. Wanjun, C. Donghua, W. Ming Opt. Laser Technol. 41 (2009) 81–84
[29] T. Jüstel, H. Bechtel, W. Mayr, D.U. Wiechert, J. Lumin. 104 (2003) 137–143
[30] A. N. Yerpude, S. J. Dhoblea D. Haranath Luminescence (2013)
[31] L. Jiang, C. Chang, D. Mao J. Alloy. Compd. 360 (2003) 193–197
[32] L. Jiang, C. Chang, D. Mao, C. Feng, J. Alloy. Compd. 377 (2004) 211–215
[33] T. Kida, M. Rahman, M. Nagano J. Electroch. Soc. 153 4 (2006) H82-H85
[34] G. Blasse, W.L. Wanmaker, J.W. Vrugt, A. Bril, Philips Res. Rep. 23 (1968) 189–200
[35] L. Jiang, Ch. Chang, D. Mao , Ch. Feng Opt. Mater. 27 (2004) 51–55
[36] T. Aitasalo, J. Hölsä, M. Kirm, T. Laamanen, M. Lastusaari, J. Niittykoski, J. Raud, R. Valtonen Radiat. Meas.Vol. 42, 4–5 (2007) 644–647
[37] Y. Lin, Z. Zhang, Z. Tang, X. Wang, J. Zhang, Z. Zheng, J. Eur. Ceram. Soc. 21 (2001) 683–685
[38] Y. Lin, Z. Tang, Z. Zhang, C.W. Nan J. Alloy. Compd. 348 (2003) 76–79
[39] Y. Wang, Z. Wang, P. Zhang, Z. Hong, X. Fan, G. Qian, Mater. Lett. 58 (2004) 3308-3311
[40] F. Clabau, A. Garcia, P. Bonville, D. Gonbeau, T. Le Mercier, P. Deniard, S. Jobic, J. Solid State Chem. 181 (2008) 1456–1461
[41] G. Talwar, C. P. Joshi, S. V. Moharil, V. K. Kondawar AIP Conf. Proc. 1391 (2011) 511-513
[42] N. Lakshminarasimhan, U.V. Varadaraju Mater. Res. Bull. 43 (2008) 2946–2953
[43] D. Dutczak, A. Milbrat, A. Katelnikovas, A. Meijerink, C. Ronda, T. Jüstel J. Lumin. 132 (2012) 2398–2403
[44] Y. Lin, Y, Z. Tang, Z. Zhang, X. Wang, J. Zhang J. Mater. Sci. Lett. 20 (2001) 1505–1506
[45] Y. Lin, C.W. Nan, X. Zhou, J. Wu, H. Wang, D. Chen, S. Xu, Mater. Chem. Phys. 82 (2003) 860–863
[46] Ch. Shi, Y. Fu, B. Liu, G. Zhang, Y. Chen, Z. Qi, X. Luo, J. Lumin. 122–123 (2007) 11–13

[47] W. Pan, G. Ning, X. Zhang, J. Wang, Y. Lin, J. Ye J. Lumin. 128 (2008) 1975–1979
[48] A.A. Sabbagh Alvani, F. Moztarzadeh, A.A. Sarabi, J. Lumin. 114 (2005) 131–136
[49] Y. Ding, Y. Zhang, Z. Wang, W. Li, D. Mao, H. Han, C.Chang J. Lumin. 129 (2009) 294–299
[50] J. Kuang, Y. Liu, J. Zhang, L. Huang, J. Rong, D. Yuan, D. Solid State Commun. 136 (2005) 6–10
[51] J. Kuang, Y. Liu, J. Zhang, J. Mater. Sci. 41 (2006) 5500–5503
[52] Y.Li, Y. Wang, Z. Wang, X. Xu, Y.Li, Y. Gong J. Electrochem. Soc., 157 (2010) J271-J274
[53] T. Aitasalo, J. Hölsä, T. Laamanen, M. Lastusaari, L. Lehto, J. Niittykoski, F. Pellé, Ceram.-Silikáty, 49 (2005) 58–62
[54] T. Aitasalo, D. Hreniak, J. Hölsä, T. Laamanen, M. Lastusaari, J. Niittykoski, F. Pellé, W. Strek, J. Lumin. 122–123 (2007) 110–112
[55] Y. Gong, Y. Wang, Y. Li, X. Xu, W. Zeng Optic Express Vol. 19, No. 5 (2010) 4310-4315
[56] W. Zeng, Y. Wang, X. Xu, Y. Gong Functional Materials Letters, Vol. 04, No. 03 289-293
[57] L. Jiang, C. Chang, D. Mao, B. Zhang, B Mater. Lett. 58 (2004) 1825–1829
[58] X.J. Wang, Z.Y. He, D. Jia, W. Strek, R. Pazik, D. Hreniak, W.M. Yen Microelectron. J. 36 (2005) 546–548
[59] S. Yao, Y. Li, L. Xue, Y. Yan J. Alloys. Compd. 490 (2010) 200-203
[60] Y. Miyamoto, H. Kato, Y. Honna, Y, H. Yamamoto, K. Ohmi, J. Electrochem. Soc. 156 (2009) J235–J241
[61] K. Van den Eeckhout, P.F. Smet, D. Poelman J. Lumin. 129 (2009) 1140–1143
[62] B.Lei, K. Machida, T. Horikawa, H. Hanzawa, N. Kijima, Y. Shimomura, H.Yamamoto J. Electrochem. Soc. 157 (2010) J196-J201
[63] K.Van den Eeckhout, P.F. Smet, D. Poelman Materials 4 (2011) 980-990
[64] C. Li, Q. Su J. Alloy. Compd. 408–412 (2006) 875–878
[65] J. Sanchez-Benitez, A. de Andre, M. Marchal, E. Cordoncillo, M. Vallet Regi, P. Escribano J. Solid State Chem. 171 (2003) 273–277
[66] R. Pang, C. Li, S. Zhang, Q. Su Mater. Chem. Phys. 113 (2009) 215–218
[67] R. Pang, C. Li, L. Shi, Q. Su J. Phys. Chem. Solids 70 (2009) 303–306
[68] Liu, L.; Li, C.; Wang, S.; Su, Q. Appl. Phys. Lett. 8 (2006) 241107
[69] D. Jia, W. Jia, D.R. Evans, W.M. Dennis, H. Liu, J. Zhu, W.M. Yen Trapping processes in CaS:Eu2+, Tm3+. *J. Appl. Phys. 88* (**2000)** 3402–3407
[70] D. Jia,. J. Electrochem. Soc.153 (2006) H198-H201
[71] C. Guo, Q. Tang, D. Huang, C.Zhang, Q. Su, J. Phys. Chem. Solids 68 (2007) 217–223
[72] C. Guo, C. Zhang, Y. Lü, Q. Tang, Q. Su Phys. Stat. Sol. (A) Appl. Mat. 201 (2004) 1588–1593
[73] P.F. Smet, N. Avci, D. Poelman. J. Electrochem. Soc. 2009, 156, H243-H248