>>**Entry Name: Aluminium yttrium oxide ($Al_5Y_3O_{12}$)**
Synonym(s): Pentaaluminium triyttrium dodecaoxide. Yttrium aluminium garnet. YAG

CAS Registry Number: 12005-21-9
Related CAS Registry Numbers(s): 12003-86-0 12043-20-8 88506-07-4
Extra CAS Registry Numbers(s): 37243-54-2

$Y_3Al_2(AlO_4)_3$

Molecular Formula: $Al_5O_{12}Y_3$
Molecular Weight: 593.618
Accurate Mass: 593.564222
Percentage Composition: Al 22.73%; O 32.34%; Y 44.93%
General Statement: Cubic garnet struct.
Source/Synthesis: Obt. from the melted oxide or hydrothermal synth. from Y_2O_3, Al_2O_3, in 6*M* aq. K_2CO_3. Alternative low-temp. synth involves reaction of $Al(NO_3)_3$ + $Y(NO_3)_3$ + citric acid at 80° (citrate gel process); significantly lower temp. employed than other conventional methods, e.g. 1600°
Use/Importance: Laser host material. When $Ce^{3(+)}$-activated, used in flying-spot scanner for colour TV signals. $Nd^{3(+)}$ doped for laser applications. Used to make artificial diamonds. $Eu^{3(+)}$/$Tb^{3(+)}$ doped material used as phosphors in high-resolution display devices; $Sm^{3(+)}$ doped material has potential use in pressure-sensitive sensors
Physical Description: Colourless cryst. (melt)
Melting Point: Mp 1980° (1970°)
Other Data: Several related phases descr. n_D 1.835. Gd analogue also descr. $Y_4Al_2O_9$, $YAlO_3$ also descr.. High-purity polycrystalline (particle size 20-70 nm) material obt. by low-temp citrate gel process

>>**Variant: $YAlO_3$**
Synonym(s): Aluminium yttrium oxide ($AlYO_3$)

Molecular Formula: AlO_3Y
Molecular Weight: 163.886
Accurate Mass: 163.872133
Percentage Composition: Al 16.46%; O 29.29%; Y 54.25%
Source/Synthesis: Material synth. by MOCVD of $Y(dpm)_3$ and $Al(acac)_3$ on single cryst. (110) $LaAlO_3$ substrate at 800° is an insulator in high-temp. superconducting devices

References:

Bertaut, M. *et al.*, *C. R. Hebd. Seances Acad. Sci. Ser. C*, 1956, **243**, 1219
Van Hook, H.J.*, J. Am. Ceram. Soc.*, 1963, **46**, 121, *(synth)*
Gensic, I.E.*, Appl. Phys. Lett.*, 1964, **4**, 182, *(use)*
Cockayne, B.*, J. Am. Ceram. Soc.*, 1966, **49**, 204, *(synth)*
Tarte, P.*, Spectrochim. Acta A*, 1967, **23**, 2127, *(ir)*
Bril, A. *et al.*, *Phillips Tech. Rev.*, 1971, **32**, 125, *(use)*
Messier, D.R. *et al.*, *Am. Ceram. Soc. Bull.*, 1972, **51**, 692, *(synth)*
Liebetz, J.*, Angew. Chem., Int. Ed.*, 1973, **12**, 291, *(rev)*
Nekvasil, V. *et al.*, *Czech. J. Phys., Sect. B (Engl. Transl.)*, 1974, **24**, 810, *(Nd, magnetism)*
Abell, J.S. *et al.*, *J. Mater. Sci.*, 1974, **9**, 527, *(phase diagram)*
Kolb, E.D. *et al.*, *J. Cryst. Growth*, 1975, **29**, 29, *(synth)*
Emraliev, A. *et al.*, *Kristallografiya*, 1976, **21**, 211, *(cryst struct)*
Danielmeyer, H.G.*, Lasers*, (Lavine A.K. *et al*, Ed.) Marcel Dekker, 1976, **4**, 1, *(rev, uses)*
Akhmetov, S.F. *et al.*, *Zh. Neorg. Khim.*, 1977, **26**, 2966; *Russ. J. Inorg. Chem. (Engl. Transl.)*, 1977, **22**, 1613, *(synth, props, tga)*
Shishido, T. *et al.*, *J. Am. Ceram. Soc.*, 1978, **61**, 373, *(Gd analogue)*
Kirk-Othmer Encycl. Chem. Technol., 3rd edn., Wiley, 1978, **11**, 721; **19**, 852, *(use)*
Valentich, J.*, J. Mater. Sci.*, 1979, **14**, 371, *(thermal props)*
Bates, J.L. *et al.*, *J. Am. Ceram. Soc.*, 1981, **64**, C138, *(elec cond)*
Han, B. *et al.*, *Chem. Mater.*, 1993, **5**, 14, *(synth, $AlYO_3$, thin films, use, sem, high resoln em)*
Vaqueiro, P. *et al.*, *J. Mater. Chem.*, 1998, **8**, 161-163, *(synth, powder struct, ir, tem)*