Nonlinear Optical Materials

Nonlinear optical (NLO) materials have long been known to interact with light, to produce a nonlinear response and the composition of these materials, generally falls into one of two classes, either inorganic or organic.

Inorganic NLO materials such as lithium niobate ($LiNbO_3$) or potassium dihydrogen phosphate (KH_2PO_4) are known to exhibit second harmonic generation (SHG) effect.[1] Lithium niobate powders have attracted a great deal of attention due to their potential applications mainly because of its unique electro-optic, acousto-optic, and nonlinear optical properties.[2] Over the last 40 years, lasers using inorganic materials have been employed as optical materials and consequently these materials have dominated optical technology.

During the 1990's, p-electron organic materials were identified as promising candidates for nonlinear optical applications.[3] However, more recent studies of NLO materials have focused on the use of organic materials with π-electron conjugated systems.[4] Such materials offer the advantages of larger optical nonlinearity and faster optical response.[5] Other driving forces behind the recent development of organic NLO's include higher bandwidth, lower driving voltage, more flexible device design, and potentially lower processing cost.[6] For chromophores to be of utility for nonlinear optical applications, they must be assembled into a noncentrosymmetric lattice.

Alfa Aesar offers a wide range of inorganic and organic NLO materials.

INORGANIC

Item	Description
A15283	Ammonium dihydrogen phosphate, 98%
11598	Ammonium dihydrogen phosphate, ACS, 98.0% min
10633	Ammonium dihydrogen phosphate, Puratronic®, 99.998% (metals basis)
14250	Barium metaborate, 90%
A17644	Cesium dihydrogen arsenate, 99.99%
10741	Lithium niobium oxide, Puratronic®, 99.9995% (metals basis)
A12142	Potassium dihydrogen phosphate, 98+%
11594	Potassium dihydrogen phosphate, ACS, 99.0% min
10840	Potassium dihydrogen phosphate, Puratronic®, 99.999% (metals basis), Si 10ppm max
10843	Potassium niobium oxide, Puratronic®, 99.999% (metals basis)
A14638	Sodium 1-decanesulfonate, 99% (dry wt.), water <1.5%
A17805	Lithium niobium oxide, 99.99%

Nonlinear Optical Materials

ORGANIC

Item	Description
B22769	2-Aminofluorene, 97%
A14368	2-Amino-3-nitropyridine, 99%
A11352	2-Amino-5-nitropyridine, 98%
L00770	2-Chloro-3,5-dinitropyridine, 98+%
A16586	2-Chloro-4-nitroaniline, 98+%
B21932	Crystal Violet
22866	Crystal Violet, ACS, 90+%
B21329	N,N'-Dimethylurea, 98%
A12888	Ethyl 4-dimethylaminobenzoate, 99%
A15548	N-Methyl-4-nitroaniline, 97%
A15941	2-Methyl-4-nitroaniline, 98%
L13112	3-Methyl-4-nitroaniline, 99%
A17174	Nile Blue A
A11055	2-Nitroaniline, 98%
A10629	3-Nitroaniline, 98%
A10369	4-Nitroaniline, 98%
A10608	5-Nitroindole, 99%
L06099	4-Nitro-3-picoline N-oxide, 98%
A12448	5-Nitrouracil, 98+%
A10779	7,7,8,8-Tetracyanoquinodimethane, 98%
A12470	2-Vinylnaphthalene, 97%, stab. with ca 0.4% 4-tert-butylcatechol

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[3](a) F. Pan, et.al., Appl. Phys. Lett., 1999, **74**, 492; (b) T. Kaino, et.al., Adv. Funct. Mater., 2002, **12**, 599; (c) M. Thakur, et.al., Appl. Phys. Lett., 1999, **74**, 635; (d) W. Geis, et.al., Appl. Phys. Lett., 2004, **84**, 3729; (e) F. Pan, et.al., Appl. Phys. Lett., 1996, **69**, 13; (f) U. Meier, et.al., J. Appl. Phys., 1998, **83**, 3486.
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[5]L. R. Dalton, Pure Appl. Chem., 2004, **76**, 1421.
[6](a) Y. Shi, et.al., Science, 2000, **288**, 119; (b) L. R. Dalton, et.al., Adv. Mater., 2002, **14**, 1339.