

# Intermediates for NLO Polymers

The last decade has seen an increasing trend towards the use of organic polymers as photonic components because of their ease of processing and fabrication; compatibility with metals, ceramics, semiconductors, and glasses; good mechanical strength; and flexibility to tailor nonlinear optical properties.<sup>1</sup> A primary requirement for a material to exhibit nonlinear optical (NLO) activity is that it should be noncentrosymmetric. In polymer-based NLO materials, the chromophore can be incorporated into a polymer matrix in a number of ways. Early efforts focused on guest–host systems. Alternatively, the chromophores were covalently attached to the polymer backbone as side chains, or made part of the polymer backbone itself, markedly improving long-term stability, and permitting their use in practical devices.<sup>1,2</sup>

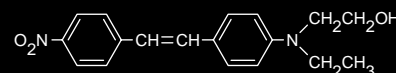
Aldrich offers a wide selection of **intermediates for NLO polymers**; a sampling of these, including some of our recent additions, are highlighted below with application information. This is followed by some of the better-characterized **NLO chromophores**.<sup>3</sup> For a comprehensive list, request your **FREE copy of the Aldrich Stains & Dyes Catalog**; for recent additions, visit our award-winning Web site, [www.sigma-aldrich.com](http://www.sigma-aldrich.com), and search our product database in eight different ways including by substructure! If you are interested in special grades, e.g., low–metals dyes, please contact us at [aldrich@sial.com](mailto:aldrich@sial.com). To obtain quotes on larger quantities, please contact Sigma-Aldrich Fine Chemicals on the Web at [www.sigma-aldrich.com/safc](http://www.sigma-aldrich.com/safc) or by phone at **800-336-9719 (USA)** or your local office.

## Intermediates for NLO Polymers & Chromophores

**NEW!** **51,489-6 3-[(4-Nitrophenyl)azo]-9H-carbazole-9-ethanol** **1g**  
Used in the synthesis of a photorefractive homopolymer with pendant azocarbazole moieties so that all of the necessary elements of photorefractivity have been incorporated into a single monomer.<sup>4</sup>

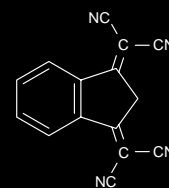


**NEW!** **51,856-5 2-[Ethyl[4-[2-(4-nitrophenyl)ethenyl]phenyl]amino]ethanol, 98%** **250mg**

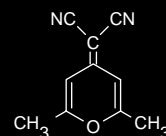


Employed in the synthesis of a second-order chromophore covalently attached to a photorefractive terpolymer.<sup>5</sup>

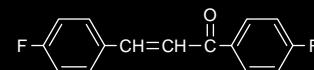
**NEW!** **46,461-9 (Indan-1,3-diylidene)dimalononitrile, 97%** **1g; 5g**  
Intermediate for the strong electron-withdrawing acceptor moiety in the synthesis of a novel push-pull chromophore.<sup>6</sup>



**NEW!** **51,688-0 (2,6-Dimethyl-4H-pyran-4-ylidene)malononitrile, 99%** **1g**  
Dye intermediate used in the synthesis of an electrooptical chromophore.<sup>7</sup>



**47,212-3 trans-4,4'-Difluorochalcone, 98%** **1g; 5g**  
Utilized in the synthesis of a quasi-two-dimensional charge-transfer chromophore containing main-chain polymers. This enhances mechanical and thermal properties, while retaining optical transparency and NLO effects, when compared to single-crystal chalcone chromophores.<sup>8</sup>



## NLO Chromophores

**86,099-9 Crystal Violet, certified (C.I. 42555)** **2g; 25g; 100g; 500g**  
**22,928-8 Crystal Violet, A.C.S. reagent** **25g; 100g**  
**36,482-7 Disperse Red 13 (C.I. 11115)** **5g; 25g**  
**36,483-5 Disperse Yellow 7 (C.I. 26090)** **5g**  
**37,006-1 3-Methyl-4-nitropyridine N-oxide, 98%** **1g; 5g**

### References:

(1) *Nonlinear Optics of Organic Molecules and Polymers*, Nalwa, H.S.; Miyata, S., Eds.; CRC Press: Boca Raton, FL, 1997. (2) Prasad, P.N.; Williams, D.J. *Introduction to Nonlinear Optical Effects in Molecules & Polymers*; John Wiley & Sons: New York, NY, 1991 (Aldrich Catalog No. Z22,382-4). (3) For a wider selection and application statements, see "NLO Chromophores" *J. Mater. Res.* **2000**, October Back Cover. (4) Ho, M.S. et al. *Macromolecules* **1996**, *29*, 4613. (5) Zhao, C. et al. *Chem. Mater.* **1995**, *7*, 1237. (6) Gonzalez, M. et al. *Tetrahedron Lett.* **1999**, *40*, 8599. (7) Beckmann, S. et al. *Adv. Mater.* **1999**, *11*, 536. (8) Tao, X.T. et al. *Chem. Mat.* **1996**, *8*, 1326.



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