Application Note

USING OPTICAL FLUIDS & GELS

Optical Coupling Fluids & Gels serve as a "bridge" for light signals by carrying light between different media such as transparent plastic or glass light pipes or lenses. These materials, also known as ***Index Matching*** fluids and gels, are used to optimize light transmission (by matching the refractive index of the mating materials) while allowing pliable mechanical connections between rigid parts. Unlike a rigid optical epoxy, Nye's pliable gels are viscoelastic and can take up the differential thermal expansion of precision optical parts without inducing excessive stresses or delamination. In many devices, these materials serve an additional function: they help seal out ambient dust or fluids from sensitive optical components. Nye's optical fluids and gels are formulated to be ultraclean, non-yellowing, and unaffected by x-ray, ultraviolet or sunlight exposure. They have extremely low outgassing and volatility characteristics, and are free from light-absorbing microscopic particulates. Nye's optical products are chemically stable, non-toxic, synthetic materials with wide temperature serviceability and are suitable for designs with high reliability and long service life.

Examples of Applications for optical fluids and gels include: fiber optic splices & connectors (Bellcore GR-2919), electro-optic components, projection & display optronics, optical instruments, boroscopes & endoscopes, microscope stage optics, optical transceivers, and optical sensors.

Nye's Optical Products are organized into three families with different fluid/mechanical characteristics. ***Optical coupling fluids*** are true fluid materials used in applications where free fluid flow is advantageous. ***Non-curing optical gels*** are ready-to-use materials with high apparent viscosity, and similar in feel to a soft putty. ***Curing optical gels*** are available in two-part curing systems; the end user must mix the product components in the specified mix ratio and the product will then cure in place (with a cured consistency which can range from that of a stale gelatin to a medium hard rubber). Curing gels flow easily into tight spaces and are more elastic than non-curing gels. Their disadvantage compared to non-curing gels is that they have a limited shelf life (typically, six months) and must be mixed and cured by the user.

Selecting the Best Optical Coupling Material for Your Application. Once you have determined which mechanical consistency is best for your application (fluid, non-curing gel, or curing gel), the next step is to determine the ideal index of refraction for optical coupling. Usually, the ideal index is equal to the value of the index of refraction of the two light-transmitting plastics or glasses which are to be "bridged" by the optical fluid or gel. If the mating materials have different indices of refraction, then the geometric mean of the two indices usually approximates the best choice for the optical fluid or gel.

Nye's Optical Coupling Kit is an excellent design tool. You can order Nye's Optical Coupling Kit to conduct prototyping studies. The kit includes three popular Nye products and a handy chart that lists the index of refraction for many common transparent optical plastics and glasses. Or, you can choose the most promising material(s) from the following partial list of popular Nye Optical Products.

OPTICAL FLUIDS & GELS

OPTICAL FLUIDS	Index of Refraction	Typical Applications
OCF-446	1.46	telecommunication splices and connectors (Bellcore GR-2919)
OCF-452	1.52	plastic light guides, display optics, optical metrology
OCF-463	1.63	sensors, display optics, optical metrology, microscopy

NON-CURING GELS	Index of Refraction	Typical Applications
OC-431A-LVP	1.46	telecommunication splices and connectors (Bellcore GR-2919)
OC-440	1.51	plastic light guides splices & connectors, electro-optic devices, transceivers
OC-459	1.59	electro-optic devices, photodetector lightguides
OC-462	1.63	sensors, display optics, optical metrology, microscopy

CURING GELS	Index of Refraction	Typical Applications
OCK-433	1.46	telecommunication splices and connectors (Bellcore GR-2919)
OCK-451	1.51	plastic light guides splices & connectors, electro-optic devices, transceivers

Nye also offers a material evaluation kit for design prototyping

The NYE OPTICAL COUPLING KIT contains:	Index of Refraction
OC-431A-LVP, non-curing gel, 1.5cc syringe	1.46
OCK-451, curing gel, 2 X 3cc vials (mix 1:1 by weight)	1.51
OCK-451, precured in sheets, (4 ea., 10mm x 10mm x 1 mm)	1.51
OC-462, non-curing gel, 1.5cc syringe	1.62
Index of Refraction Chart for optical plastics & glasses	
Assortment of syringe tips	
Technical Data Sheets for all three products	
Material Safety Data Sheets for all three products	

To Purchase an Optical Coupling Kit: Contact Nye's authorized small volume distributor, TAI Lubricants, Monday through Friday 8:00 am to 5:00 pm (Eastern Time), at tel. 1-302-326-0200, fax. 1-302-326-0400. MasterCard and VISA accepted.

For More Information: For a more detailed description of the Optical Coupling Kit, technical specifications, reprints of technical articles, evaluation samples, or questions about any Nye products – or to discuss an optical coupling material custom-designed for your application – call us at (508) 996-6721, visit our website at www.nyeoptical.com, or contact us by email at: techhelp@nyeoptical.com.

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