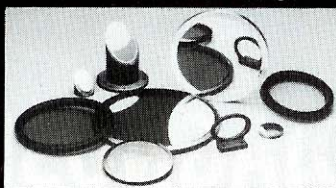


Custom Pellicles



**24 hours
to 2 weeks!**
1/16" to 48" and larger!
Ultra-custom designs estimated.

Custom Coatings

- Dichroic ■ Infrared ■ No Loss
 - Attenuators ■ Anti-Reflective
- ### Custom Frames
- Oval ■ Square ■ Rectangular ■ Brass
 - Elliptical ■ Truncated Cylinders
 - Stainless Steel ■ Aluminum ■ Others
 - Critical Flatness/Transmission Requirements Met/Documented ■ Quantity discounts available ■ Expert Prototype Design

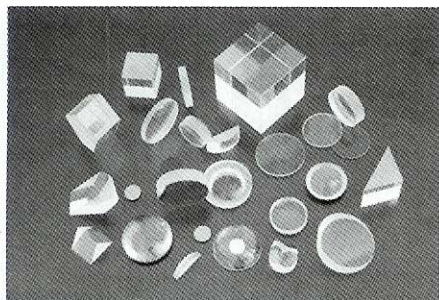
**NATIONAL
PHOTOCOLOR**
CORPORATION

428 Waverly Avenue, P.O. Box 586
Mamaroneck, NY 10543-0320 USA
Tel: (914) 698-8111 Fax: (914) 698-3629

Tel: 800-698-8151
Fax: 800-698-3629

www.nationalphotocolor.com

FOR FREE DATA WRITE IN NO. 21



a wide range of custom optics

Prisms

- ◆ Right Angle Prism
- ◆ Penta Prism
- ◆ Roof Prism
- ◆ Cornet Cube Prism
- ◆ Wedge Prism
- ◆ Dove Prism

Windows

- ◆ BK7 Window
- ◆ Fused Silica Window
- ◆ Ge Window
- ◆ Si window
- ◆ Float Glass Window

Lens

- ◆ Spherical Lens
- ◆ Cylindrical Lens
- ◆ Aspherical Lens

Filter

Mirror

Beamsplitter

high quality & just-in-time

Fuzhou Kire Operonics Co., Ltd.

#11 Qinyuan Zhi Rd, Fuzhou, Fujian

350013 P.R. China

Tel: 86(0)591 7588833 Fax: 86(0)591 7575777

E-mail: sales@kireinc.com Http://www.kireinc.com

FOR FREE DATA WRITE IN NO. 22

optoelectronics worldnews

obtained from GaAs and other compound semiconductors traditionally used to make light-emitting diodes," said Salvo Coffa, manager of the research team at ST.

Jalali also expects to achieve such efficiencies. "I think we can look forward to a new era for optical devices in which we make use of good old silicon to make the devices instead of having to rely on more exotic material and devices," he said. "That doesn't mean that silicon is going to completely

replace gallium arsenide and indium phosphide for this purpose, but I think there could very well be commercial silicon optical devices on the market that perform a subset of the functions performed by the indium phosphide, gallium arsenide devices."

Hassaun A. Jones-Bey

REFERENCE

1. R. Claps et al., *Optics Express* 10(22) 1305 (Nov. 4, 2002)

TUNABLE GRATINGS

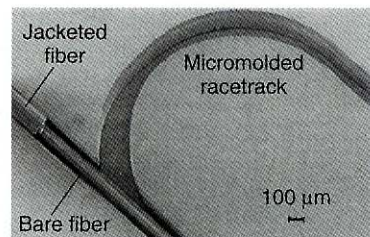
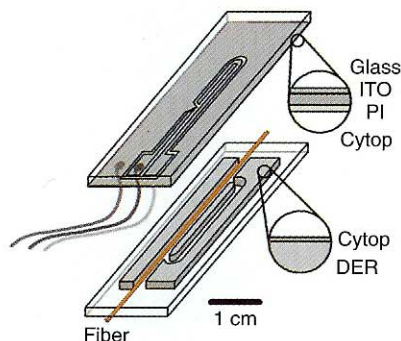
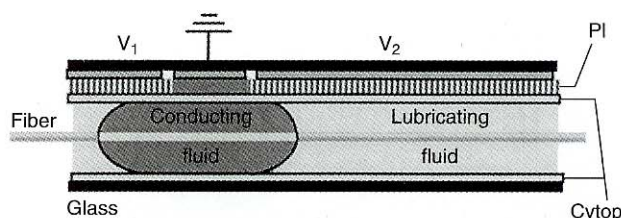
Simple microfluidic system tunes fiber properties

Researchers at Lucent Technologies Bell Laboratories (Murray Hill, NJ) have developed an easily manufactured device that allows the tuning of optical-fiber properties without the need for moving parts or specialized thermal control. In addition, the new system is easy to manufacture, low in cost, and low in power, requiring less than 1 mW for a switching speed of 100 ms or less. The device—

which does not depend on the use of special fibers—should also eventually be integrable with planar waveguides.

The microfluidic system was developed by a group that last year demonstrated a system that involved manipulating liquid inside an optical fiber.¹ The cladding of the fiber used was structured with a series of holes circling the core—holes that were then filled up with liquid. Through the use

of built-in heaters, plugs of liquid of a high refractive index (with low-index liquid on either side) could be moved to a sensitive section of the fiber that was patterned with a



100 μm
LUCENT TECHNOLOGIES

A cross section of a tunable microchannel fiberoptic device shows a plug of conducting fluid in an environment of lubricating fluid with the fiber passing through the middle of the channel (top). The device is made in two sections: a lower plastic microchannel, and an upper glass lid and pump (bottom left). Cytop is a hydrophobic coating used to promote liquid flow, DER is the photocurable resin used to make the channels, PI is polyimide, and ITO is indium tin oxide, a transparent conductor. Photo shows a portion of the actual device (bottom right).

long-period grating, reducing the effectiveness of the grating. Thus, by changing the overlap length between plug and grating, the properties of the fiber could be tuned.

The problem with this method was the exotic fiber required to make it work, so the team decided to simplify the idea.² The new strategy was to use a stripped fiber and locate the liquid on the outside. Again, a plug of high-index liquid would be moved along the length of the fiber and, again, the overlap between this plug and the fiber grating would reduce the grating depth and change its properties. However, this time the plugs would not be manipulated through heating, but instead through an applied voltage.

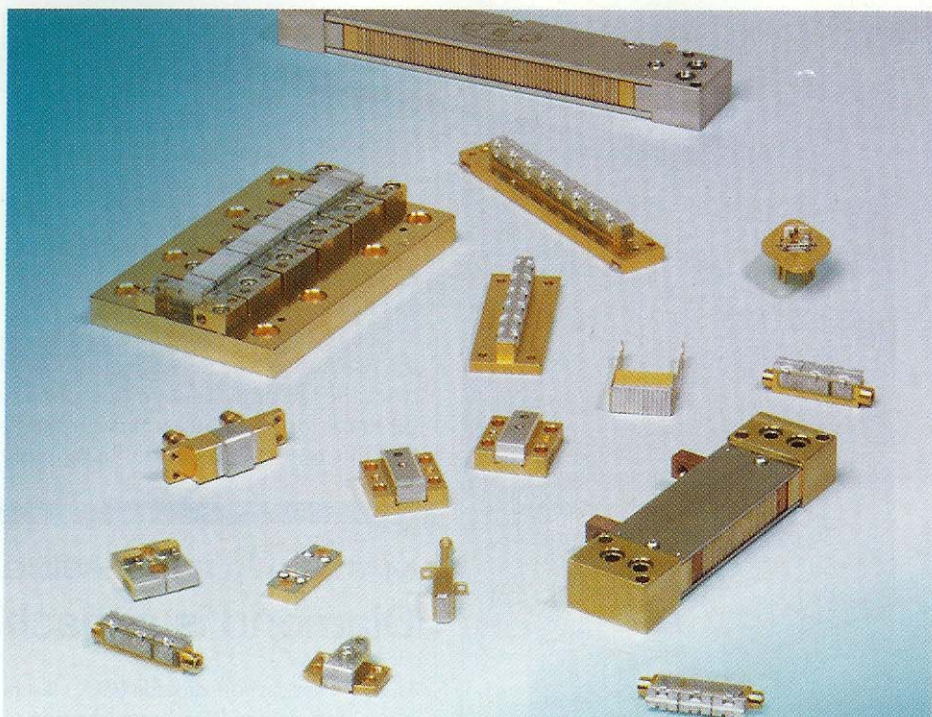
The team designed a microfluidic channel in the shape of a racetrack, combined with a straight channel for the fiber itself (see figure). This section of the device is made using micromolded plastic. Above this, a plastic "lid" is attached that contains a patterned indium tin oxide electrode followed by an insulating polyimide layer. All the inner surfaces of the device are coated with a hydrophobic substance called Cytop, which allows liquids to flow easily over it.

Assembly

After the parts are manufactured, assembly requires stripping a short section of fiber from its jacket. At the ends of this section, the still-plasticized fiber is tightly held by the microchannels. In between, the fiber is automatically centered and exposed for contact with the liquid. The liquids used include a low-viscosity lubricating fluid that does not affect the operation of the fiber grating, and a high-index conducting fluid that acts as the plug.

Once the device is sealed, the two electrodes are set at different voltages, providing a driving force for the plug. It turns out that, thanks to the lubricating fluid, the plug never actually touches the sides of the microchannel device, which along with the Cytop prevent it from sticking to the sides.

Experimental results are encouraging. In one device, the researchers demonstrated the switching of a 5-mm etched fiber grating that formed part of a broadband attenuator. They found that the microfluidic tuning of the filter led to an insertion loss of less than 1 dB and a dynamic range of more than



In-Stock Wavelengths

Just some of the laser building blocks available at CEO

CEO offers stocked-to-build arrays in a variety of wavelengths from 790-810, 900, 915, 940, 980, 1450 and 1540. All wavelength values are approximate, based on package and operating parameters.

You can choose any silver bullet configuration, or we'll customize a package to meet your application needs. CEO offers arrays that are interchangeable with most existing configurations. It's that simple.

Available in: lensed and unlensed, CW and QCW. Special wavelengths available on request.

FOR FREE DATA WRITE IN NO. 23 OR GO TO WWW.ONLINECENTER.TO/LFW

CEO
CUTTING EDGE OPTONICS

NORTHROP GRUMMAN

20 Point West Blvd. • St. Charles, MO 63301 • 636-916-4900 • Fax: 636-916-4994
www.ceolaser.com • info@ceolaser.com

Laser Focus World www.laserfocusworld.com April 2003 **25**

LASER DRIVE, INC.

Now Offering Capacitor Charging Power Supplies

Advanced High-Energy Conversion Technology

Laser Drive, Inc., a primary source for HeNe, Argon Ion, and Diode laser power supplies since 1976, has now extended its high-energy conversion technology to include Capacitor Charging Power Supplies.



Capacitor Chargers General Information

INPUT

- Universal Line Input
- Power Factor Correction (>.98)

Output

- 5KV, Positive or Negative
- 3000 Watt Average Power
- Output Voltage Regulation to .1% (low ripple)
- Integrated Trigger Output (optional)
- Integrated Auxiliary Output, 24 volt, 6 amp (optional)

ACCESSORIES (OPTIONAL)

- Simmer Power Supply
- Line Voltage Filter
- External Trigger

GENERAL INFORMATION

- Medical Approvals
- Custom Designs Available

Contact our Sales Department today to learn how Laser Drive Capacitor Charging Power Supplies can be used with medical, commercial and industrial devices and equipment.



**LASER
DRIVE
INC.**

(724) 443-7688
Fax: (724) 444-6430
www.laserdrive.com

FOR FREE DATA WRITE IN NO. 24
OR GO TO WWW.ONLINECENTER.TO/LFW

75 dB. This particular device—which used a machined Teflon spacer rather than one made of plastic—switched in less than 30 ms.

One interesting outcome was that the rise time of the device was almost twice the fall time. Though they don't yet know for sure, researchers speculate that this results from a combination of

hysteresis related to the contact angle of the plug and motion of the fiber caused by the liquid flow.

Sunny Bains

REFERENCES

1. P. Mach et al., *Appl. Phys. Lett.* 80(23), 4294 (June 10, 2002).
2. J. Hsieh et al., *IEEE Photon. Tech. Lett.* 15(1), (January 2003).

MATERIALS PROCESSING

Diamond is a machinist's best friend

High-power carbon-dioxide (CO₂) lasers place great demands on beam-shaping optics. If even a small fraction of a high-power beam is absorbed in an optical element, a large thermally induced expansion can result, causing thermal lensing and potentially fracturing the element. In the conventional solution, zinc selenide (ZnSe)—which has an optical absorption coefficient of 0.0005 cm⁻¹ at the 10.6-μm CO₂ wavelength—minimizes thermal expansion by keeping the element's absorbed power low.

In a second approach, taken by researchers at Uppsala University (Upp-

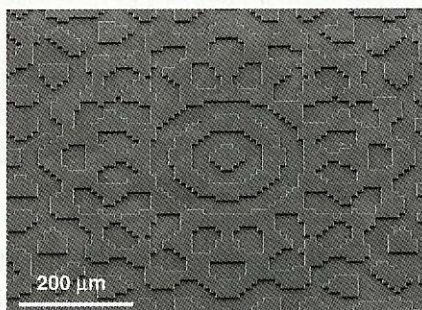
to 2200 W/mK (vs. 16 to 18 W/mK for ZnSe) and its low thermal-expansion coefficient of 1 × 10⁻⁶/K (vs. 7.1 × 10⁻⁶/K for ZnSe). These and other properties of diamond make the material a better choice than ZnSe for diffractive beam-shaping optics used in materials processing, say the Uppsala researchers.

For example, not only is diamond 80 times harder than ZnSe and 100,000 times more resistant to sand erosion, it is also unaffected by concentrated acids, to which ZnSe is susceptible. Materials processing, including cutting and welding, often takes place in—or creates—an erosive, caustic environment.

The researchers have fabricated binary fanout diffractive optical elements (DOEs) from diamond for use with CO₂ lasers, as well as for use with HeNe lasers for test purposes (see Fig. 1). The fabrication was done by contact photolithography and plasma etching of 10-mm-diameter, 0.3-mm-thick polycrystalline diamond substrates. Because the whole substrate is structured, the laser beam can strike the DOE anywhere and still produce the desired beam fanout.

A test on a DOE designed for a 633-nm HeNe laser beam showed that virtually all the light went into the proper diffraction orders, with only a faint zero-order spot observed. When a 543-nm He-Ne laser was used, the zero-order spot became very apparent, as expected. In both cases, the fanout spots were uniform to about 4%. Variations in feature depth on the DOE affect diffraction efficiency but don't affect spot-to-spot uniformity, say the researchers.

"The depth deviation was around 3% to 5% for both the 633-nm element and



UPPSALA UNIVERSITY

FIGURE 1. A diamond diffractive optical element handles high power from a carbon dioxide laser without thermally lensing or shattering. The element accepts a single beam and fans it out into 16 separate beams angularly spaced around a circle. The microstructure of the element (seen here in a scanning-electron micrograph) was created photolithographically.

sala, Sweden), diamond—which has a much higher absorption coefficient of 0.03 to 0.1 cm⁻¹—minimizes thermal expansion by taking advantage of diamond's high thermal conductivity of 1900