2PP of ORMOCERs will be used for the low-cost fabrication of artificial microstructured and nanostructured components for different applications in optics, medicine, and biology.

STEVEN TROHALAKI

Microfluidic Plugs Produce Long-Period Gratings in Microstructured Optical Fiber

With the development of wavelength-division multiplexing, bandwidth has been significantly increased over the past few years, but for continued advancement, dynamic filters and attenuators need to be developed. Researchers at OFS Laboratories in New Jersey have developed a microstructured optical fiber (MOF) whose wavelength-dependent attenuation can be modified by a long-period grating, composed of an alternating air/liquid refractive index, in the cladding.

As described in the March 3 issue of *Applied Physics Letters*, C. Kerbage and B. Eggleton, who is now director of the photonics research center called CUDOS at the University of Sydney in Australia, have developed a method of alternately drawing fluid (in this study, trifluorotoluene) and air into the holes of the MOF. This is achieved by repeatedly dipping a cleaved fiber in a liquid reservoir while subjected to a vacuum on the other end of the fiber. When the fiber is submerged, it draws in liquid, and when it is not submerged, it draws in air. In order to produce attenuation in the 1550-nm communications window, a duty cycle of 125 Hz was used, corresponding to a grating period of 460 μm. While the microfluidic plugs are in the cladding of the fiber and should not strongly interact with the light propagating down the 8-μm-diameter germanium-doped core, the fiber has been tapered to extend the single-mode field into the cladding. The higher-order modes in the cladding then interact with the periodic refractive-index mismatch, causing high losses at a determined wavelength. As the fiber tapers back to its original diameter and into the single-mode fiber, the higher order modes are attenuated while the fundamental mode continues to propagate.

While the use of long-period gratings is not a new technology in fiber optics, such gratings have lacked the degree of tunability of the MOF with microfluidic plugs. With both ends of the fiber coupled to a single-mode fiber, the ends of the MOF fiber can be heated, creating an expansion of the air in the ends of the fiber. The air between the microfluidic plugs is compressed, changing the period of the grating. The fiber then exhibits wavelength tunability. According to the researchers, this type of fiber holds promise for devices in optical communication and fiber sensing.

JEFFREY R. DIMAIO

Research on Self-Assembled Monolayer Field-Effect Transistors Concludes Previous Reports are Implausible

Last year, much of J.H. Schön's innovative work at Lucent on field-effect transistors made from self-assembled dithiol monolayers was judged to be fraudulent by an independent review committee. However, questions remained within the molecular electronics community as to which, if any, of the results of Schön's discredited research could be achieved. Recently, a group of researchers from IBM T.J. Watson Research Center have investigated Schön's system to elucidate the limitations and the key requirements necessary to fabricate molecular devices. While the researchers were unable to reproduce Schön's results, they identified some of the design rules necessary to fabricate molecular devices, which include the high purity of molecules for self-assembly and a thorough characterization of the surfaces at each step of the fabrication on both molecular and device-area levels. The researchers also determined that the molecular-device structure must be characterized both structurally and electrically. In addition, the research team explained that tunneling places a lower limit on channel length, and therefore molecular length, to ~3 nm. In addition, electrostatics requires gate dielectrics with thicknesses of less than 2/3 the molecular length, although they are also subject to tunneling limitations.

As reported in the February issue of *Nano Letters*, C.R. Kagan and co-workers created prototypes of the devices having the structure of field-effect transistors ("trench" and planar Si structures) with self-assembled monolayers of 1,1′-biphenyl-4,4′-dithiol instead of an inorganic semiconductor. The prototypes were studied in detail after each step of preparation. The geometry of the devices on Si wafers was fabricated using lithography, reactive-ion etching, and anisotropic wet-etching techniques. After this, a uniform film of gate dielectric was formed. Source and drain electrodes were prepared by collimated evaporation of Au and Ti on the gate dielectric. Self-assembled monolayers of dithiols formed on the source electrodes were characterized by local imaging probes such as scanning tunneling and atomic force microscopies, as well as large-area characterization by, for example, contact-angle measurements and ellipsometry.

The researchers found that biphenylmonothiol and biphenyldithiol form disordered layers with, at best, small (~10 Å) ordered regions, and that molecules such as alkanethiols assemble to form ordered domains separated by disordered boundaries. The devices made of the well-washed monolayers of 1,1′-biphenyl-4,4′-dithiol formed electrical shorts, contrary to the characteristics reported by Schön, but consistent with the expected physics for these disordered, short molecule assemblies.

In efforts to uncover the origin of the *I–V* characteristics reported by Schön, the IBM research team formed molecular multilayers with longer channel lengths. The researchers, however, did not observe significant gate field effect; furthermore, they found that obtaining significant field effect and turning the device off are fundamentally impossible. Despite the evidence of recent misconduct, though, the research team said that "there is no scientific reason to lose faith in the tremendous promise of this field."

An exploration of Schön's work was also carried out by a research team in The Netherlands; see the MRS Web site at www.mrs.org/gateway/matl_news.html.

MAXIM NIKIFOROV

X-Rays Generated Using Graphite Nanofiber Cold Cathode with Copper Anode

X-ray imaging has numerous technological and medical uses. To produce x-rays, typically a heated cathode emits electrons by thermionic emission (TE); the electrons then accelerate through a high potential difference before they bombard a metal target anode. The hot-cathode method has several drawbacks, such as the short lifetime of the hot cathode as it reacts with residual gases and the low efficiency of the TE process. In the March 10 issue of *Applied Physics Letters*, researchers report the creation of a point x-ray source using a graphite nanofiber (GNF) cold cathode and a conical copper anode, yielding a high-resolution x-ray radiography system and thus eliminating the need for a cooling system required for hot-cathode sources.

The GNFs were grown on a hot steel plate by thermal chemical vapor deposition from CO and hydrogen. From their analysis of the diffraction pattern observed

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