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Fiber-Optics Grow

The worldwide fiber-optic materials market, which primarily consists of cables, transmitters, receivers and connectors, is excepted to grow at 20% per year from 1993 to 1998. The current $5.3 billion (US) market is predicted to reach $14 billion (US). This growth is due to the increased penetration of fiber opitcs into the telecommunication networks. The biggest growth area is the Asia/Pacific region, which will be second only to the North American region in 1998. The major growth in the Asia/Pacific region will be from countries other than Japan and Australia, which account for 70% of the Asia/Pacific market today, but is expected to drop to 59% by 1998. During this time, however, the North American segment will show only a small decrease from 31% of the worldwide market in 1992 to 27% in 1998.

The spending on feeder/local loop telephony applications for the first time exceeded amount spent on long-haul cable installations, since most of the networks are now in place in the United States, Germany and Japan. The changing nature of the markets is also reflected in the amount of spending on cables, transceivers (transmitters and receivers) and connectors which is currently at about 75:20:5 ratio, respectively, and is forecasted to change to 60:30:10 ratio by 1998.

This portends good news for the rare earth producers and manufacturers, since the rare earths are utilized in silica based glass materials as additives for a variety of applications [see **RIC Insight 6**, Nos. 3, 4, 7 and 11 (March, April, July and November, respectively, 1993)] and as a major component and also as additives in heavy metal fluoride phases [see **RIC Insight 6**, [5] (May, 1993) and earlier citations given therein]. It would be a real bonanza if the production and manufacturing of high quality fluoride glasses becomes a reality in the late mid-1990's and begins to replace silica based glass for long distance optical transmission cables.

YSZ Aids in Growing Diamond Films

Diamond films are one of the important materials in the semiconductor arena, because of its unique electrical properties such as its wider band gap, higher breakdown voltage and higher hole mobility relative to the conventional semiconductors, such as silicon and gallium arsenide. Thin-film diamond semiconductors with controlled doping have been available for about ten years. To be able to build diamond semiconductor devices one needs to be able to mask selective areas on substrates, such as silicon. T. Maki and co-workers, Department of Electrical Engineering, Osaka University, Japan, [**Jpn. J. Appl. Phys., 32**, 3227-30 (1993)] have developed a process which employs yttria-stabilized zirconia (YSZ) as a thin film mask. The YSZ films were

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prepared by two different techniques: one used a pulsed ArF excimer laser and the other rf-diode sputtering. The rf-diode sputtering technique resulted in a much better masking effect than the former method when the diamond film was grown by microwave plasma-assisted chemical vapor deposition (CVD) with CO/H_2 source gas. The procedure for the selective deposition of diamond was carried out as follows. The silicon substrate is scratched by a diamond powder using an ultrasonic technique. A resist was then patterned on the scratched silicon substrate by using a photolithographic method. The YSZ (6 mol% Y_2O_3) was then deposited using the rf-diode sputtering deposition technique. After the YSZ thin film was lifted off in acetone, the diamond was deposited on the silicon substrates patterned by the YSZ film using the CVD process noted above.

Full Color Thin Films Electroluminescence Displays

Thin film electroluminescence (TFEL) technology for flat panel displays are one step closer to realization if the promising results by French scientists are confirmed. Although the yellow monochromic manganese-doped ZnS phosphor displays have been in commercial use for over one decade, it is still the only TFEL in the marketplace. The lack of other colors has held back the development of a full-color TFEL panel. P. Benalloul and colleagues at the Université Pierre et Marie Curie, Paris, France, have prepared an europium (Eu^{2+})-doped $SrGa_2S_4$ thin film which emits a sufficiently bright green light for use as a TFEL phosphor [**Appl. Phys. Lett. 63**, 1954 (1993)]. Furthermore, when $SrGa_2S_3$ is doped with Ce^{3+} it emits a deep blue light. Both emissions give significantly better color coordinates than any of the binary sulfides of Zn, Ca or Sr. Furthermore, the $SrGa_2S_4$ host is less hygroscopic than other ternary semiconducting hosts, i.e. $M^{II}M_2^{III}$ (S, Se)$_4$ where M^{II} = Ca, Sr or Ba, and M^{III} = Al, Ga, In or Y. The $SrGa_2S_4$:Eu films were prepared by reactive magnetron sputtering. The TFEL phosphor contains 3 mol% Eu, and was grown in an argon atmosphere containing 1 to 3 mol% H_2S. After deposition, the films were annealed for 5 hours in a vacuum at 400 to 600°C. The sulfur matrix allows the acceleration of charge carriers by a high electric field to optical energies, and provides the electroluminescence. Some problems, however, need to be solved before this material will be utilized in TFEL panels. These include improved crystallinity and an increase of injected charge carriers, as well as improved excitation efficiency.

Shandong Venture Completed

Last month **RIC Insight** (**6**, No. 12, December 1, 1993) noted that Advanced Material Resources Ltd. (AMR) was involved in discussions with the Chinese about acquiring a rare earth processing facility in Shandong Province, People's Republic of China. Early in December AMR released details concerning their acquisition of the Zibo (Linzi District) rare earth factory, which has the capacity to process 1000 tons of rare earth chloride to produce a variety of separated rare earth oxides and metals. AMR will own an 80% interest in this joint venture and will sell the factory's products on the world market.

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