Rare-earth Information Center INSIGHT

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Magnequench to be Sold to San Huan!

On March 22, 1995, **The Wall Street Journal** reported that General Motors Corporation's (GM) President's Council approved a plan to sell its Magnequench operation to San Huan Group, Inc. of Beijing. This sale is part of GM's plan to restructure its parts and components business. **The Wall Street Journal** notes that "the agreement includes $56 million in cash, a $14 million note and a guarantee that San Huan will honor GM's 1993 national contract with the United Auto Workers union." This agreement and the above mentioned details have not been confirmed by GM or San Huan. Furthermore, the terms of the sale still needs to be approved by the Board of Directors of GM.

Magnequench was reported to have had sales of $75 million in 1994, and to employ about 400 persons at its Anderson, Indiana facility. This plant, which opened in 1986, manufactures and markets Nd-Fe-B magnets for electrical motors and other products.

Photophones

Much of today's voice communications are carried by optical fibers, but in order to hear the sound, the light pulses must be converted into electrical signals which cause a mechanical arm to vibrate and generate the sound. Because this conversion process slows the transmission of information, it has been the goal of scientists and engineers to eliminate the electronic go-between and directly convert light into sound. A big step in this direction was reported, at the Fall meeting (November 28-December 2) of the Materials Research Society, by K. Uchino from Pennsylvania State University. Uchino made a vibrating arm, similar to those used in today's telephones, using a photostriction material that converts light directly to a mechanical movement by making use of the photovoltaic and piezoelectric effects in PLZT. The former effect converts light energy into electricity and the latter converts electrical energy into physical motion. PLZT is a lead-lanthanum-zirconium titanate compound, which had been slightly modified by Uchino by adding a trace of tungsten oxide. Uchino used two 20 mm long strips of PLZT with concentration gradients of zirconium and titanium along the length of the strips. He bonded the two strips such that the concentration gradients were opposite to one another. When he flashed a light onto one side of this bicouple, the device bent to one side, and when the light was shone on the other side, it bent in the opposite direction. By rapidly alternating the light from one side of the bicouple to the other, the device vibrated back and forth up to 80 times a second. This low frequency is barely audible to the human ear, but if the frequency can be increased by a factor of two or three times it will be easy to hear the sound.

It appears that we are just a few steps away from a prototype demonstration photophone. If this device works as envisioned, and PLZT remains the material of choice, it could open an important new market for lanthanum, but not before the turn of the century.

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More on FED's

Last month **RIC Insight** (**8**, [3]) noted that the Raytheon Co. is about to start production on FED's — field emission displays. Since then RIC has learned that six other companies are more or less actively involved in FED technology. These include: Coloray, Futaba, Micron Display Technology, SI Diamond, Silicon Video Corp., and Texas Instruments. Coloray is said to begin pilot plant production in 1997 with full production a year later. Futaba has built a 12.5 cm (5 in.) prototype, but little else is known about their plans. Micron Display Technology is expected to have displays for camcorder viewfinders available in 1996, and is said to be working on large displays for computer applications. SI Diamond will be using their diamond thin-film technology in their FED's. They claim that the diamond FED's will require 20% of the capital cost, operate at half the power consumption and cost one-fourth the price of conventional liquid crystal displays (LCD's). Silicon Video Corp. is reported to have plans to start production of 25 cm (10 in.) FED's by the end of 1996 with full production in 1997. Texas Instruments is still evaluating the situation and is not expected to make a decision whether or not to produce FED's until the end of the year. As noted last month, most FED's, especially color displays, will use rare earth phosphors. This could be a strong and important market for rare earth companies involved in the supply of rare earth materials and/or the production of phosphors.

Super GMR Effect Bested by a Factor of Ten

In the June 1, 1994 issue of **RIC Insight** (**7**, [6]) we noted the discovery of an extraordinarily large giant magnetoresistance (GMR) effect, which was about 1000 times larger than had been observed up to that time. Now this record has been bested, by about one order of magnitude, by G. C. Xiong *et al.* [**Appl. Phys. Lett. 66**, 1427 (March 13, 1995)]. Xiong and co-workers, who are with the Center for Superconductivity Research, University of Maryland, measured a $-\Delta R/R_H$ greater than 10^6% in a thin film of $Nd_{0.7}Sr_{0.3}MnO_x$ (where $x \approx 3$) at 60 K in a magnetic field of 8 T (80 kOe). The previous record was measured on $La_{0.67}Ca_{0.33}MnO_x$. The epitaxial Nd-Sr-Mn-O film (~2000 Å thick) was deposited on a (100) orientation $LaAlO_3$ single crystal substrate in a N_2O atmosphere using a pulse laser deposition technique. After deposition the sample was heat treated at 900°C in one atmosphere O_2 for a half hour.

As-grown films (i.e. without a post O_2 anneal) also have large GMR ratios. The maximum value reported by these authors was -3340%, at 95K and at a magnetic field of 5 T. The authors claim this is the largest value reported to date for *in situ* films.

Things seem to be moving rapidly on the GMR front and we can expect many new and exciting developments to occur in the next few years, including some primitive devices making use of these large resistance changes with an applied magnetic field.

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