



# Rare-earth Information Center INSIGHT

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## Good - Bad - Good News on Magneto-Optics

Recently Japanese scientists have found that by adding more than 5 at.% Cr to TbFeCo films the corrosion resistance can be improved without losing their superior magnetic and magneto-optical properties. Thin film devices of  $\sim 1000\text{\AA}$  thickness of TbFeCo-base alloy were deposited on a polycarbonate substrate using DC magnetron sputtering. A  $900\text{\AA}$  thick  $\text{SiN}_x$  film was deposited over the magneto-optic alloy as a protective and interference layer. The corrosion resistance was evaluated by measuring the change of the light transmitted through a  $1000\text{\AA}$  thick film of the TbFeCoCr alloys deposited on glass (without the protective  $\text{SiN}_x$  layer) when the alloy was dipped in a 1 N NaCl aqueous solution. The transmittance increased by a factor of 4 for the base TbFeCo alloy in 1 hr. As the amount of Cr was increased the rate of corrosion dropped dramatically, at 7 at.% no change was observed after 1 hr. Furthermore, no corrosion pits were observed. The corrosion resistance was also tested by measuring the change in transmission of the alloy after holding in an 85% relative humidity,  $85^\circ\text{C}$  air atmosphere. The 7 at.% Cr alloy again showed no change even after 8 days of testing. The authors also determined the coercivity, the Kerr rotation, magnetization and Curie temperature as a function of the Tb, Fe and Co concentrations to determine the optimum magneto-optic properties. The alloy  $\text{Tb}_{19}\text{Fe}_{45}\text{Co}_{29}\text{Cr}_7$  was found to have the most desirable properties: excellent corrosion resistance,  $0.3^\circ$  Kerr rotation angle, coercivity of 5.2 Oe, and a high readout carrier to noise ratio of 51 dB at 1.76 MHz. This work was reported by a group of IBM scientists working at the IBM Research Laboratory (Tokyo) and the Fujisawa Plant, headed by S. Takayama [J. Magn. Magn. Mater. 94 357 (1991)].

Another IBM group (Almaden Research Center) are working to replace the rare earth-transition (RTM) amorphous alloys by growing Co-Pt superlattices using molecular beam epitaxy. They found that the Co-Pt superlattice grown along the (111) crystallographic orientation have a perpendicular magnetic anisotropy, which is necessary for magneto-optic recording. Presumably the Co-Pt alloy is much more corrosion resistant than the RTM alloys. The group headed by E. Marinero believes that the Kerr rotation will be adequate for use at shorter wave lengths which would allow higher storage densities. It remains to be seen if these goals can be reached. Presumably, by controlling the Co layer thickness and the distances between the Co layers (i.e. the Pt layer thickness) the desirable properties can be attained. This could be bad news some time in the future.

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Another potentially good news item comes from this year's Summer Consumer Electronic Show. The big item was the combining of television and compact discs into a potential new offspring -- a multimedia CD player. The CD's cost about \$1000 and will combine text, graphics, animated cartoons, video and digital stereo sound. The discs are expensive, \$35 to \$70, but because it is computer-interactive, the person(s) watching will be involved in running the show. For example, a single disc of Grolier's Electronic Encyclopedia, which costs \$50, will contain 33,000 articles (11 million words, 2300 pictures). The electronic encyclopedia can talk to you in the voices of historic persons, or one can listen to the music of a composer while reading about them, or one can view birds in full color while listening to their calls. Since these are interactive, the viewer can manipulate what one sees, for example one can move closer to an object being viewed and examine it from all sides, as if he/she were walking around it. The multimedia CD player is called CD-I by Philips/Magnavox and CDTV by Commodore International. The two systems, which are incompatible, are expected to be available this fall. It appears that most of the European and Japanese manufacturers will be marketing CD-I compatible products, while Commodore is the only one using CDTV technology. Initially ROM (read only memory) CD's will be used, but as people become accustomed to the new format and as engineers become more innovative, expect to see more personal interaction and input from the viewer and this will require erasable and writable CD's and this is where the RTM amorphous alloys will shine. If this should catch on it will give a big boost to the rare earth metal markets.

#### Protective Surface for Heavy Metal Fluoride Glasses

One of the major problems to be solved if heavy metal fluoride glasses are to be used as optical fibers is their lack of resistance to aqueous corrosion. Japanese scientists at Asahi Glass Company [Y. Dai et al., Appl. Phys. Lett. 58 422 (1991)] have found that by implanting 15 keV oxygen ions at a dose of  $2 \times 10^{17}$  ions/cm<sup>2</sup> can significantly improve the corrosion resistance of the 53ZrF<sub>4</sub>-20BaF<sub>2</sub>-4LaF<sub>3</sub>-3AlF<sub>3</sub>-20NaF(ZBLAN) fluoride glass. The surface layer is modified by the implanted oxygen ions forming a chemically stable oxyfluoride layer which provides the excellent chemical durability against aqueous corrosion. This coating had essentially no affect on the visible and infrared transmission of the glass.

#### Australian Ownership Changes

Recently Muswellbrook Energy and Minerals Ltd. has sold all its rare earths interests to Remproc Ltd. Remproc is a company owned and operated by Sir Russel Madigan, former Deputy Chairman of CRA and Director of RTZ. Remproc noted that approval of the environmental impact statement for SX Holding's Port Pirie site is expected shortly. Following the approval Remproc will be seeking investors to develop the cracking of the monazite and other rare earth processing facilities.

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