Rare-earth Information Center INSIGHT

Ames Laboratory
Institute for Physical Research and Technology
Iowa State University / Ames, Iowa 50011-3020 / U.S.A.

Volume 5 | June 1, 1992 | No. 6

Karl Strnat: 1929-1992

On May 1, 1992 Karl J. Strnat, the father of rare earth permanent magnets, died from an unexpected heart attack. In 1966 he (along with G. I. Hoffer) found that YCo_5 had an extremely large uniaxial magnetocrystalline anisotropy and a theoretical energy product which was unheard of, and suggested it would make an excellent permanent magnet. A year later, several groups, including Strnat and co-workers showed that $SmCo_5$ was the best permanent magnet of the RCo_5 materials. In the intervening 25 years he made many valuable contributions to the science and technology of rare earth permanent magnets, including organizing the first few International Workshops on Rare Earth Magnets and Their Applications.

Karl was a wonderful and compassionate person, always willing to help others. We have lost a great friend and an outstanding scientist and engineer. He will be sorely missed by all who knew him. More details will be published in the September issue of the **RIC News**. If you wish to have more details before then, call or fax or write RIC and we will send you what information we have.

Workshop Proceedings Available

A few days ago RIC received a copy of the proceedings from the "Workshop on the Basic and Applied Aspects of Rare Earths" held in Venice on May 9-10, 1991 {**Mater. Chem. Phys.** 31 [1,2] (March-April 1992)}. Of the papers published in this special issue of the journal, five papers may be of interest to our readers of **RIC Insight**. These include papers on: (1) glass technology by B. Locardi and E. Guadagnino, pp. 45-49; (2) Nd-doped solid state lasers by K. Washio, pp. 57-63; (3) "Rare earth industry update" by P. Falconnet, pp. 79-83; (4) "Treibacher activities on Rare Earths" by E. Baumgartner, pp. 89-91; and (5) "Rare earth applications and their market in China" by Liu Yujiu, pp. 85-88.

FED to Rescue CRT from LCD

A new emerging technology, FED, may have an impact on the use of liquid crystals in flat screens displays (LCD's) for computer and TV screens. Two years ago **RIC Insight** (**3**, [6], June 1, 1990) reported that scientists from Sharp Corp. in Nara, Japan predicted that CRT (cathode ray tubes) displays, which are a very important market for rare earth phosphors, would peak in 1993 and by 1997 more LCD's would be produced than CRT's. However, if FED, which stands for field emission display, catches hold, the growth of LCD's may not be as rapid as predicted, and the CRT rare earth phosphor market would resume its growth, which was about 6% per year in the late 1980's and early 1990's.

- Over -

Telephone: (515) 294-2272
Facsimile: (515) 294-3709
Telex: 269266
BITNET: RIC@ALISUVAX

In a FED display screen, which is composed of an array of thousands of miniature electron emitters, any one emitter will, at the command of an electronic signal, emit electrons which strike a phosphor emitting light just as in a CRT display. The maximum electron emitter tip diameter (at its base) is about 0.8 µm, and around each tip is a "gate" aperture about 1.0 µm in diameter. The total thickness of a FED is about 2 mm, the thickness of the cover of a hardback book. A high electric field is applied to the tip, to reduce the metal/ vacuum barrier so that the electron escapes into the vacuum by quantum-mechanical tunneling. This contrasts to thermionic emitters where the tips have to be heated to a high temperature (~1500°C) before the electrons are emitted.

Apparently French researchers at the LETI government laboratory in Grenoble have built the first working version of such a video screen. Some scientists and engineers believe the FED's may be lighter, cheaper, easier to see, and operate on less power than the LCD's. Since the FED's emit light much like current CRT TV and computer screens, it may be easier to see because of the sharper contrast as compared to a LCD. Furthermore, since LCD's do not emit light (they reflect or channel it) they require external illumination, which adds to the weight and power consumed by LCD. The lower power consumption should allow a FED laptop computer to run longer on its battery before recharging. Finally, since FED's require less precision and fewer steps to manufacture a display, it is quite likely to be cheaper than a LCD.

A number of companies in the USA and Japan are actively working on FED's or soon will be. The most optimistic prediction is that the first FED models for laptop computers will be in production by 1995.

In addition to the nice boost to the phosphor market, it is possible that the FED's could utilize rare earths as coatings on the tips to improve their emission characteristics, as they do for tungsten thermionic emitters. Of course, even better, would be the use of LaB_6 or CeB_6 as the emitter tips, but the cost is probably prohibitive, compared to tungsten (see following story).

CeB_6 to Replace LaB_6?

Work being carried out at FEI Co. of Beaverton, Oregon showed that CeB_6 has a lower vaporation rate than LaB_6 at the normal operating temperatures (~ 1500°C) of thermionic cathodes. LaB_6 is one of the important thermionic cathode materials in electron microscopes and electron beam lithography systems. In addition, the work function of CeB_6 is ~10% smaller than that of LaB_6. In field tests researchers from FEI Co. found that CeB_6 cathodes lasted up to 10,000 hours in a scanning auger system, which is about three times the normal lifetime of LaB_6 in the same system. The cost of the CeB_6 cathode is about 10% more than LaB_6, but one can expect the cost to be about the same, when full-scale production of CeB_6 has started.

Karl Gschneidner, Jr.

K. A. Gschneidner, Jr.
Director, RIC