Rare-earth Information Center INSIGHT

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CeF_3 Scintillator for Medical Imaging

Scientists at the Fermi National Accelerator Laboratory have discovered that CeF_3 is a fast, high density scintillator which can be used in positron emission tomography (PET). In PET medical imaging a positron-emitting isotope is introduced into a patient and during positron annihilation a pair of 511 kV photons are emitted. The photons are detected by CeF_3 scintillators and an image of an organ of the patient is built up. PET allows one to track a specific chemical as it travels through the body, or to see how the chemical is being used by the body. Some metabolic studies require high speed tomography and therefore a fast scintillator, and CeF_3 is the only known scintillator that is fast enough and is not prohibitively expensive. Currently bismuth germanate is the commonly used scintillation crystal in PET cameras, but its response time is rather slow (decay constant is 300 nano seconds) and it is quite expensive and accounts for ~20% of the cost of a PET camera -- the most expensive component. CeF_3 is ~10 times faster than bismuth germanate, is expected to cost about half that of the bismuth germanate, and operates well with standard photomultipliers.

With CeF_3 PET cameras scientists believe it will be easier to determine the heart condition by measuring the relative amounts of fatty acids and glucose being used by the heart, thus heart disease can be reliably predicted and prevented. The use of CeF_3 PET medical imaging will allow medical personnel to determine the cell growth rate in tumors within hours after receiving radiation therapy (currently it takes days, even up to a week occasionally). Other possibilities opened up are the use of CeF_3 PET cameras to image the brain and thereby obtain new insight into the brain functions. Non-medical uses include the ability to trace circulation systems, (such as pumps, manifolds, or values) and high-energy physics research.

Erbium Amplifier

Erbium-doped silica fiber amplifier is now a commercial reality. The first fiberoptic amplifiers utilizing erbium were put into the market place by BT & D Technologies, a joint venture of British Telecom and DuPont. Other companies, such as AT & T and NTT, are expected to have competing units available soon, if they are not already on hand. The erbium amplifier is pumped by a diode laser at either 980 or 1480 nm, and gains of 2.6 dB/mW have been achieved at the latter wavelength. Today repeaterless links of

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over 2000 km (1250 miles) have been reported, and researchers believe links of 10,000 km (6200 miles) are possible for the erbium fiberoptic amplifier.

Central Government to Oversee Rare Earths in People's Republic of China

Beginning in 1990 the entire rare earth industry in the People's Republic of China (PRC) has been put under State planning. According to the Eighth 5-Year Plan for 1991 through 1995, the PRC will not approve any new extraction plants, except for one or two key projects. Furthermore, the output of the ion absorption rare earth minerals will be reduced by 2000 tons by 1995, and all joint Sino-foreign co-operations, such as research, exploration, mining, and extraction, regarding the ion absorption minerals has been stopped and will not be allowed in the future. These minerals are considered a special resource by the PRC's State Planning Commission and will not be open to foreign visitors. Aside from the ion absorption mineral, the State Planning Commission has also put controls on the export of rare earth extraction technology. The Chinese, however, are encouraging foreign businesses to invest in other projects involving rare earths.

Mt. Weld Project

In early November, D. J. Kingsnorth, Marketing Manager of the Mt. Weld Project of Carr Boyd Minerals (now a subsidiary of Ashton Mining Ltd. -- a diamond producer), presented a status report on this vast rare earth deposit, which is 35 km south of Laverton in the Eastern Goldfields of West Australia [see **RIC Insight 2**, [8], (August 1989)]. The present indications are that Mt. Weld contains at least 17.0 million tons (mt) of monazite containing 10.2% rare earths; of this, 6.3 mt have a content of 16.2% rare earths and 1.35 mt grades as high as 23.6%. The yttrium oxide content, which is present in the churchite mineralizaiton in the deposit, amounts to 9.3 mt with a grade of 0.28% Y_2O_3; of which, 3.0 mt contain 0.36% Y_2O_3 and 0.14 mt contains 0.58% Y_2O_3. This is probably the richest rare earth deposit known. Furthermore, the deposit is low in thorium. The mix of light lanthanides in the monazite and the yttrium plus heavy lanthanides in the churchite allows a greater flexibility of production and the potential to react quicker as the demand for the various rare earths change.

Bench scale and pilot plant studies on the beneficiation based on phosphate flotation has produced monazite concentrates acceptable to conventional cracking and rare earth extraction processes. Current plans call for a beneficiation plant at Mt. Weld producing 10,000 tons of concentrate per year which will be further processed near Perth. The feasibility study is expected to be complete in little over a year from now, and if things are favorable the mining will start in 1994. Carr Boyd Minerals expects to supply about 10% of the world's rare earth production when the Mt. Weld project is fully operational.

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