Rare-earth Information Center INSIGHT

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Rare Earth Fertilizers Update

Australian scientists and engineers have been sufficiently interested in the successes reported by the Chinese in applying rare earth fertilizers to a variety of crops, that they have undertaken several studies. The results of these preliminary tests and investigations on Australian crops and soils were discussed at a workshop in Melbourne several months ago. There were reports of some pot tests on sugar cane which did not show much difference between the rare earth-treated and non-treated sugar cane, except for some root growth promotion due to the rare earths. Field tests were carried out on wheat and cotton, but no spectacular, and possibly some doubtful results were obtained. The representatives from several agricultural research organizations decided that from the inconclusive data obtained from the field trials, that it would be best to undertake some basic research into the application of the rare earths on crops. The attendees did not agree to a collective approach, but they decided that each organization would examine proposals for work in their own fields of interest.

Some unpublished results and private communications to RIC indicate that U.S.A. scientists have also had little success in improving crop yields using rare earth fertilizers. Part of this lack of success by non-Chinese scientists may be due to the dearth of experience and know-how, especially since the Chinese have been working on this application for many years. The Chinese scientists have noted that the timing of the application of the rare earth fertilizer is crucial, but there could also be a few other details which the Chinese have not divulged. The soil type, pH, moisture, other chemical elements, etc. may also play a critical role.

$BaCeO_3$ Hydrogen Sensor

High temperature hydrogen sensors for measuring the hydrogen concentration in metallurgy and chemical processing plants are generally unavailable. Several years ago H. Iwahara and his co-workers found that Yb-doped $SrCeO_3$ solid electrolyte could be used as a hydrogen sensor by measuring the EMF generated when the hydrogen partial pressure in the two electrode compartments of a cell differ. Recently Iwahara and co-workers found that $BaCeO_3$-based ceramics exhibited higher protonic conductivity than the Yb-doped $SrCeO_3$ material [J. **Electrochem. Soc. 138**, 295 (1991)]. They found that $BaCe_{0.90}Nd_{0.10}O_{3-\alpha}$, where α is the oxygen deficit per perovskite unit cell, gave a stable voltage which was proportional to the hydrogen pressure. The

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cell had a fast response time and gave reliable hydrogen concentrations over a wide temperature range (200 to 900°C). This development looks promising, and it appears that we have another rare earth sensor (i.e. for hydrogen) about to join the rare earth family of sensor materials for detecting and measuring concentrations of ionic or molecular species, e.g. the fluoride ion, oxygen, or water vapor.

YIG Thin Films

The Industrial Technology Institute and Tosei Synthetic Rubber Company Ltd. just announced a new process for preparing yttrium iron garnet (YIG) thin films at 800°C. This temperature is about 500°C lower than is currently being used. Essentially, no details have been released, but organic compounds are said to be the key to the new process. The films produced by this process can be made quite large and are transparent. An important use of YIG thin films is as an optical isolator which allows laser light to travel in only one direction in high-performance optical fiber systems.

Transparent Loudspeaker

Sumitomo Special Metals Co., Ltd. has built some PLZT loudspeakers using their fine crystal PLZT materials. PLZT stands for lead, lanthanum, zirconium titanate. The loudspeaker consists of a glass plate covered with the transparent PLZT piezo-electric ceramic diaphragm. The diaphragm is 50 mm in diameter and 0.1 mm thick, and is composed of superfine PLTZ crystals (1 μm diameter), which are hot isostatically pressed at 2000 atm. The speaker is said to have excellent acoustic characteristics between 100 Hz and 30 kHz. The superfine PLTZ crystals have been in production for some time.

Nano Size Oxides

Yttria and ceria are among the 16 different nano-size oxide dispersions in an aqueous medium available from ZYP Coatings, Inc. for research and development (R & D) studies. The particle size of the yttria dispersion is 100 Å (10 nm), and the dispersion is available at a concentration level of 14 wt% Y_2O_3. The Y_2O_3 particles have a positive surface charge. Potential uses include catalyst support, ceramic additives, high temperature binders, fire retardant particles, and polishing compounds.

19th RERC

This newsletter is being written in early July, shortly before the editor takes off for the 19th Rare Earth Research Conference (RERC). Since he will be on vacation until early August, the first news from RERC will be featured in the September issue of **RIC Insight**.

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