Rare-earth Information Center INSIGHT

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Neodymium Market Tightens Up

Presently, the supply of Nd metal and Nd_2O_3 are tight and spot shortages of both have been reported. Information received by RIC indicates most of the producers in the world are running at capacity or are gearing up toward 100% to meet this demand. And, as expected in such a situation, the price of these Nd materials has moved up by as much as 30% in the past six months. However, most of the permanent magnet prices have remained stable, with the magnet manufacturers absorbing this increase. Rhône-Poulenc informs us that for the first time ever each of their two major processing plants in LaRochelle, France, and in Freeport, Texas, USA, are at 100% capacity. They are expected to increase their capacity to meet this expanding demand, and that of other rare earth materials, such as La_2O_3 for optical applications and as the starting material for preparing $LaNi_5$ for batteries, and CeO_2 for polishing compounds, decolorizing agents and catalysts. Molycorp has also confirmed that they have increased their Nd_2O_3 production in recent months to help meet this demand. With increased production, prices for Nd_2O_3 appear to have stabilized and even some softening has been reported.

"Clean-car"

Rare earths will be playing a role in the USA initiative called the Partnership for New Generation of Vehicles (PNGV) or more commonly known as the "clean-car" initiative. This involves the three major USA automobile manufacturers (Chrysler, Ford and General Motors) and a number of government organizations (Departments of Commerce, Defense, Energy, and Transportation; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation). The goal is to make major breakthroughs in automotive technology which will significantly increase fuel efficiency, improve safety, and reduce pollution, while maintaining affordability, performance, and utility of present day cars — a tall order.

In addition to the current uses of rare earths in automobiles (e.g. permanent magnets for electric motors, auto exhaust emission catalysts and Y_2O_3-stabilized ZrO_2 oxygen sensors), the rare earths may find significant roles in new technologies in the next generation of vehicles. These may include nickel-$LaNi_5$-based hydride batteries, (**RIC Insight 3** [8] August 1990 and **4** [9] September 1991) *improved* emission control catalysts, (**RIC Insight 5** [3] March 1992, **5** [4] April 1992, and **6** [4] April 1993), magnetic flywheels (**RIC Insight 7** [7] July 1994), and solid oxide fuel cells.

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Currently, lead-acid and nickel-cadmium batteries are used in zero-emission electric vehicles, but nickel-metal hydride batteries are projected by the California Air Resources Board to be commercially available in 1998. Many of the performance characteristics of these rare earth batteries are equal to or better than those of the lead-acid battery and meet the mid-term goals for batteries for electric automobiles, except for the cost per kWhr delivered. Other advanced batteries, such as the sodium-sulfur and lithium polymer, generally have characteristics which lie between those of the nickel-metal hydride and the lead-acid batteries. For the long-term goal, most of the battery performance levels need to be doubled, while the costs need to be halved for the seven types of batteries currently being studied.

Metal Hydride-Nickel Batteries

According to the Japanese Ministry of International Trade and Industry, the metal hydride-nickel rechargeable battery production (which includes the $LaNi_5H_x$ based materials and the Ni-Cd batteries) was 72 x 10^6 (72 M) units in 1993 for an average of 6 M per month. By March of this year, the production had increased to 12.8 M/month and by the end of 1994 it is expected to reach a total of 150 M units for the entire year. The major Japanese companies producing batteries are: Sanyo Electric Co. (expected production — 12 M/month by the end of 1994), Matsushita Battery Industry (10 M/month in the spring of 1995) and Toshiba Battery Co. (10 M/month by the end of 1994). The Ni-Cd rechargeable battery accounts for most of this production, but about 500 mt of rare earth metals will be needed in 1994. By the year 2000, the number of $LaNi_5H_x$ based batteries are expected to more than double the number of Ni-Cd batteries produced in spite of the higher cost for the rare earth containing batteries. The main reasons for this increased demand for rare earth batteries are their better performance and the fact that they are environmentally safe compared to the Ni-Cd batteries which contain chemically hazardous cadmium (see **RIC Insight 3** [8] August 1990 and **4** [9] September 1991). The Li-ion rechargeable battery will also be a competitor to the metal hydride batteries. At present 1 M units are being produced per month in Japan and production is expected to triple by the middle of 1995. These Li-ion batteries are expected to account for 18% of the market in the year 2000, compared to 58% for $LaNi_5H_x$ materials and 24% for Ni-Cd. Although the Li-ion batteries are much more expensive than the rare earth batteries, their main advantage is that their energy density is significantly higher than that of the $LaNi_5H_x$ battery which, in turn, is higher than that of the Ni-Cd materials. The main driving force for these rechargeable batteries is their use in portable tools and computers, and in wireless telephones. The expected growth in the cellular phone market will also have a large impact on this extremely rapidly growing market (they will also impact the rare earth permanent magnet market (see **RIC Insight 5** [12] December 1992 and **7** [7] July 1994). This information was excerpted, by permission of R. Ohmachi (Santoku Metal Industry Co., Ltd., Kobe, Japan), from his paper on the rare earth industry in Japan which was presented at the '94 Baotou International Symposium on Rare Earth Science and Technology, Baotou, Inner Mongolia, People's Republic of China.

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