Rare-earth Information Center INSIGHT

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More Companies Attain ISO-900X Certification

In the February 1994 issue of **RIC Insight** we noted that Johnson Matthey - Rare Earth Products was one of the first rare earth producers to qualify to meet the strict ISO-9002 quality standards in late 1993. This is still correct, but we were informed that the Rhône-Poulenc Basic Chemicals Company's Freeport, Texas, rare earth facility earned this high distinction about a year earlier by receiving their ISO-9002 certification in December, 1992. Congratulations! *Are there any other companies that reached this hallmark of excellence in 1992, or 1993, or earlier? If so, we would like to hear from you.*

More recently, we learned that Vacuumschmelze, GmbH had received their quality management ISO-9001 certification in February 1994, after a rigorous and extended examination in December 1993 of their facilities in Hanau, Speyer, and Schrobenhausen, Germany. The most recent company to achieve an ISO-9002 certification is Molycorp, Inc.'s lanthanide processing plant at Mountain Pass, California and its sales office at White Plains, New York. We extend our congratulations to both Vacuumschmelze and Molycorp for reaching this high level of achievement. *Please keep us posted at RIC and let us know when your company has obtained an ISO-900X certification.*

Nippon Rare Earth No More

Rhône-Poulenc and Sumitomo Metal Mining have ended their joint subsidiary in Japan — Nippon Rare Earth. Nippon Rare Earth was formed in 1986 to initially market Rhône-Poulenc's rare earth products in Japan, and then to start production locally (in 1987) using imported intermediates. With the early 1990's price war, the joint venture's earnings fell and finally led to the dissolution of Nippon Rare Earth at the end of 1993.

Rhône-Poulenc Japan (RPJ) will continue to import rare earth products and supply intermediates to the Santoku Group (SG). RPJ has also acquired a minority stake in Anan Kasei, a SG subsidiary specializing in rare earth salts and oxides. These products, and also those imported by RPJ, will be marketed by Santoku Metal Corp.

Eveready-Gates

Late last summer, Eveready Battery Company completed the purchase of the rechargeable batteries operations of Gates Energy Products. The aerospace and lead acid battery portions of Gates were not part of the Eveready purchase. The rechargeable battery operation is located between Alachua and Gainesville, Florida and manufactures both nickel-cadmium and

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nickel-metal-hydride batteries, which includes $LaNi_5$-based materials. The Energizer Power Systems of Eveready Battery Co., Inc., as the Florida facility is called, sells their batteries under both the Eveready and Millenium labels. In 1992, about 130 million cells were manufactured by Gates.

Scandium-Aluminum Alloys

There is a great deal of interest in aluminum alloys containing small amounts of scandium, < 0.5%, because of the significant improvements imparted to the mechanical properties of aluminum-based alloys. Such alloys are being considered as interconnects in large-scale integrated (LSI) circuits [see **RIC Insight 6** [4] (April 1993)] and high-st·ength alloys for aircraft and other applications where light weight is an important factor. Two recent papers present more details on the properties and behavior of scandium-doped aluminum alloys.

The first paper, by T. Hara and co-workers from Hosei University, Tokyo and Mitsubishi Chemical Industries, Yokohama [**Jpn. J. Appl. Phys. 32**, L1394 (1993)] discusses the improvements in aluminum used as interconnects in LSI circuits, where scandium is added from 0.05 to 0.3% (probably weight percent). The authors measured the stress in the Sc-Al alloys and compared it to the standard 1% Si - 0.5% Cu-Al alloy used as the interconnect material. They found that the stress is lowered from 327 MPa in the Si-Cu-Al alloy to 62 MPa in the 0.3% Sc-Al alloy. The stress in the former alloy is due to the precipitation of the excess Si and Cu at the Si-Cu-Al alloy-metal oxide semiconductor interface and within the grain boundaries of the aluminum alloy. In addition to the stress measurements, the authors also studied the mean times of failure under a large current density (1.0×10^7 A/cm^2) at 200°C. They found that the Si-Cu-Al failed after 52 minutes compared to 280 minutes in a 0.15% Sc-Al alloy. These accelerated tests were carried out at 200°C. Extrapolating to typical operating conditions in an LSI circuit, 80°C and a current density of 1.0×10^5 A/cm^2, they estimated failure times of 9.0×10^5 hours for the Si-Cu-Al alloy and 6.3×10^6 hours for the Sc-Al alloy - seven times longer. They also note that the time to failure increases as the scandium content increases. Based on these results, the authors conclude that the Sc-Al alloys are promising materials as quarter-micron thick interconnect layers.

The second paper, by three Russian authors from the All-Union Institute of Light Alloys [B. I. Elagin, V. V. Zakharov and T. D. Rostova, **Metalloved. Term. Obrab. Metal. 1993** [6], 8, Eng. Transl. **Met. Sci. Heat Treat 35**, 317 (1993)] discussed the results of an investigation of the microstructure of a cast alloy containing 0.4% Sc - 0.01% Fe - 0.01% Si-Al. The maximum solid solubility of scandium in aluminum is 0.4% at the eutectic temperature, and it decreases rapidly with decreasing temperature. Upon cooling, $ScAl_3$ precipitates out of the supersaturated solid solution in a discontinuous manner, forming fine grains with a fan-shaped arrangement of the $ScAl_3$ particles. Upon aging at 350°C for 17 minutes, the hardness of the alloy is nearly doubled. This confirms the earlier observations of increased hardness and tensile strength of the Al-based alloys by scandium additions. Although some mechanical properties, such as strength, have been reported earlier, additional information, such as creep resistance, mode of fracture, fatigue behavior, fabricability, etc., is required if scandium is to be an important alloying agent for high-strength lightweight aluminum-based alloys. If scandium proves to be beneficial, this would be an important and a potentially large market.

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