RARE-EARTH INFORMATION CENTER INSIGHT

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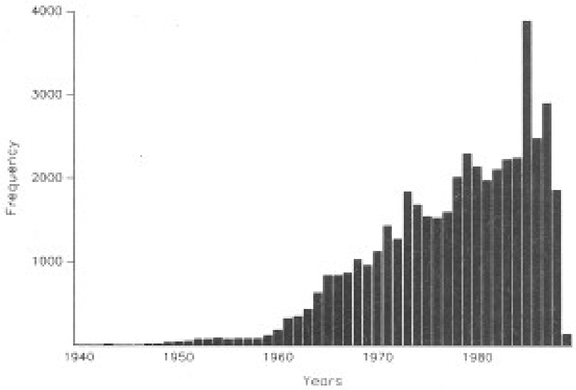
Rare Earth Information Grows



An analysis of the 47,000 plus documents in the RIC literature data file shows a steady growth in the number of papers published in the scientific and technical literature (see figure on the right). Before 1959, there was about a 6% growth rate in the numbers of papers published, but between 1959 and 1987, the average growth rate was 12.3%. Now you know why you are having a difficult time keeping up with developments. The low volume for 1988 is due to the fact that some of the 1988 papers are still coming to RIC, and many are in the process of being coded for their technical content. We expect 1988 to exceed 1987 by about this 12% growth rate. It should be noted that these numbers do not include the high temperature superconductivity papers - RIC is not entering these into its literature data files since the U.S. Department of Energy Center at Oak Ridge National Laboratory is doing this and we would be duplicating their work.

This growth in rare earth literature portends well for the industrial and commercial segments of the rare earth field since the basic and applied research papers are the fountainhead of rare earth knowledge which eventually flows into commercial products. This may not be evident from the growth of rare earth consumption reported in various publications and marketing studies because they generally report this in terms of the total tonnage of rare earths (mixed and separated together). But in the past ten years, there has been a big growth in the use of separated rare earths, now estimated to be 25% of the volume of rare earths consumed. This segment is probably growing much faster than the 12% per annum and the dollar value is much greater than that of the mixed rare earths. As long as the number of publications continues to increase, we can look forward to a healthy expansion of the rare earth industry. One must keep in mind that it takes, on the average, about ten years from the initial publication until commercial utilization is realized. Exceptions exist, e.g. the Nd-Fe-B magnets, which took about five years from the first paper by Croat in 1981 showing that large room temperature coercivities could be realized in amorphous Nd-Fe alloys.

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China Statistics

The latest (May 1989) issue of China Rare Earth Information gives the latest production, consumption and export statistics for the rare earths in 1988, and all categories are up impressively from 1987. Mine production was up by 38% to 20840 metric tons REO equivalent, making China the world's largest rare earth producer for the first time. Domestic consumption reached 6000 tons, up 28% from 1987, with the petrochemical, paints and plastics category up by 68%, and rare earth fertilizers up by 20%. The export volume totaled 8320 tons, an increase of 28%, while the export of separated rare earth products more than doubled, accounting for 3.2% of the export volume.

A part of the big increase in mine production was due to the processing of the ion-adsorption type rare earth clays from South China. The advantage of these minerals is that they are easily dissolved, compared to monazite and bastnasite, and have unusually high heavy lanthanide and yttrium contents.

Lanthanum in Cells

In a recent review on the "Effect of Lanthanum in Cellular Systems", T. Das, A. Sharma and G. Talukder [Biological Trace Elements, **18**, 201 (1988)] examined over 200 references concerning the rare earth distribution in the environment and living organisms (including humans); the mode of action of lanthanum on tissues and cells; and the effects on bacteria and plants, and on animal systems. Although the toxicity rating of the rare earths is low (as most of us are well aware), this 28 page review may be quite useful in answering some questions we or others may have on rare earths in biological systems. With the general populous' concerns about the environment and the effect of chemicals on human well-being, we need to be aware of the behaviors and the effects of the rare earths in living organisms.

The major effect of lanthanum is that it may replace a Ca^{2+} ion in a chemical compound, or act as a barrier for calcium in a subcell transport system, or some how modify the behavior of calcium in living organisms. In addition, lanthanum (and the other rare earths) have a strong affinity for the phosphate and fluoride ions, both of which form insoluble lanthanum compounds. Sometimes the rare earth may play a detrimental role, but since rare earth concentrations normally are less than 0.5 ppm by weight in plants, animals and humans, there is no adverse effect. The minimum concentrations for some of these detrimental effects are not known.

The rare earths, of course, have many beneficial uses. For example, lanthanum has been used to prevent dental cavities by displacement of calcium and deposition of lanthanum phosphate on the enamel, thus improving the aciduric resistance of teeth. The combination of La^{3+} and F^- treatment of teeth was even better than the La^{3+} treatment alone.

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