

improve the domestic supply position. Some practicable means should be found for winning beryllium from such low-grade substances.

Beryllium and its compounds have certain unique properties which, irregardless of relatively high cost, promise a growing and diversified application in special and critical end uses. Presently, beryllium-copper alloys and beryllium metal are the principal use forms. A small quantity is employed in the ceramic and chemical industry. Periodically, real or imaginary promises of new volume uses spur unusual industry activity both in the quest for better sources and for methods of processing low-grade ores and ways of introducing a concentrated product to a trade geared traditionally to hand-cobbed beryl. These periods of interest have usually been of short duration and not very productive in advancing the status of the nontraditional sources of potential supply. A modest sustained interest would be more effective than the hot and cold approach of the past.

The high cost and some processing difficulties have limited the employment of beryllium and its compounds to the most obvious and demanding applications where its unique properties are important. Anything that would improve upon the processing and forming technology and reduce costs would measurably broaden the fields of application. To the engineer, designer, and user the properties of beryllium are ideal to many new product and use concepts.

The toxicity of beryllium complicates processing techniques and end use applications and adds substantially to costs.

BISMUTH

Bismuth minerals rarely occur naturally in sufficient concentrations to permit commercial exploitation as a primary objective. They occur frequently in minor amounts in lead, copper, tungsten, and gold ores. Most domestic production results from the treatment of lead smelter products, and the rate of production is a factor of the smelting capacity. In recent years new uses have substantially increased demand for the metal and shortages have been avoided only by a drawdown on producers' stocks and through allocations. The byproduct bismuth is a measurable benefit in the economics of some smelter operations, and it is presumed that this provides sufficient incentive to promote effective recovery and efficient extraction. As a relatively high cost commodity with expanding applications and a supply not subject to much independent expansion, it would seem appropriate to seek instances where other commodities might satisfactorily substitute for bismuth.

Domestic supply could be adversely affected by the depletion of certain base metal deposits particularly rich in bismuth. Because of the mineralogical distribution, bismuth production is not necessarily a fixed ratio to the scale of smelter production. Presumably, the same conclusion applies to other world sources. In light of this eventuality, the bismuth content of ores likely to be commercially attractive in the future should be studied to gain better advanced knowledge of potential supply problems.

Better technological data are needed on the behavior of bismuth during lead and copper processing, on the bismuth content of various smelter fractions, and on the overall recoveries attendant with bismuth extraction.

BITUMINOUS COAL AND LIGNITE

Changing demand for bituminous coal had brought instability and economic hardship to the coal industry. Recently demand has exhibited moderate but consistent increases bringing a measure of stability and self-confidence to the industry. During the next decade coal consumption should continue to grow. But strong political and social forces working to reduce air pollution threaten this growth, thereby tending to discourage capital investment and to undermine confidence in the industry. Pending the successful introduction of economic methods for the removal of sulfur from coal or flue gases, the supply of low-sulfur coals will be relatively tight, and in most cases at higher costs than the conventional coals used for power generation. As a minimum, the drive to reduce pollution will disrupt some of the conventional supply-demand patterns by encouraging the production of low-sulfur coal. This is likely to increase the tendency towards larger mines and the consolidation of companies into relatively large groupings of mines. Further, there has been a trend in the affiliation of large coal companies with other energy-producing corporations. The increasing capital requirements of coal operations is likely to continue and even accelerate this trend.