

could provide sulfur while reducing air pollution. Bureau of Mines scientists have recently applied hydrometallurgy and ion-exchange technology to devise a new method of recovering sulfur from almost unlimited supplies of gypsum and anhydrite. This process promises to be economically competitive over a broad range of conditions.

IMPROVED MINERAL MATERIALS

Many industrial-type processes have been shown to be more efficient than those now operating but they cannot presently be utilized because the required materials of construction have yet to be developed. This is true in such common categories as steam power generation, metallurgical and chemical processes, and in engines for high-speed transport where higher temperature operation would result in higher output per unit of fuel.

To meet such requirements, the Department of the Interior is engaged in development of new and improved metals, alloys, ceramics, and composites which have the ability to resist highly unfavorable operating environments and also, whenever possible, combine great strength and light weight. Often, the attainment of these goals contributes to the specialized needs of the Department of Defense, the National Aeronautics and Space Administration, and the Atomic Energy Commission, but the principal activities of the Department of the Interior are directed toward materials for use in the industrial economy and toward provision for an expanded mineral resources base. Additional objectives include improvements in methods of fabricating materials and extending their service life, and the synthesis of minerals to replace natural substances which are in short supply and high in cost.

INDUSTRIAL MINERALS

Nonmetal, nonfuel minerals are essential components of the Nation's construction, chemical, and transportation industries. The annual mine output value of the raw materials (sand, gravel, crushed stone, clay, lime, crushed mica, salt, gypsum, fluorspar, spodumene, etc.) approaches \$5 billion.

Industrial minerals, in general, command low prices and, therefore, are subject to limited shipping distances. Many of them must be concentrated to meet stringent grade and impurity limitations. High-grade deposits of some of these minerals are being depleted, and economic exploitation of lower grade ores necessitates development and improvement of methods for beneficiation.

The Department's research is aimed at improving industrial recovery of those nonmetallic minerals (excluding phosphate, potash, and sulfur) that fill needs essential to the national economy, but it is restricted to areas where identified need is greatest and chances for improvement are highest. Such research is diversified and demands specific talents. Current projects include: devising methods for improving grade and recovery of kyanite, sillimanite, and feldspar from disseminated ores; development of design parameters for attrition-grinding equipment; conversion of heavy-liquid separation from batch to continuous operation; development of a new process to prepare zirconia from zircon.

HELIUM

In its helium program, the Bureau of Mines produces and sells helium for current beneficial use, acquires and stores helium for beneficial use in the future, and does research to provide new knowledge of the properties of helium as a means of extending its usefulness.

Most of the current uses for helium are in our Nation's space and missile programs, atomic energy program, undersea activities, and research. Possible future uses for helium include underground power transmission and more efficient generation of electrical power through the use of materials which are superconductors at the temperature of liquid helium.

The Bureau's helium research is for the purpose of improving processes for the extraction, purification, liquefaction, transportation, storage, and use of helium by developing more accurate thermodynamic and phase-equilibrium data for helium, and by obtaining information on various properties of helium, such as absolute viscosity, dielectric constant, solubility, and diffusion. The work is done by reviewing previous research from all known sources, evaluating and identifying errors and omissions in previous work, and by performing experiments and making measurements to fill gaps where there are no data. In addi-