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# Coal Research

Prepared under the auspices of the National Research Council, an authoritative book on coal has recently appeared that is the first comprehensive treatment of the subject in 18 years.* Publication now is particularly timely, for there is a growing consensus among energy experts that during the remainder of this century, coal will have the major role in replacing part of the energy and chemicals currently obtained from petroleum. About 75 percent of the coal used at present in the United States is burned by electrical utilities. Another 14 percent is used to make coke, and most of the remainder is burned for industrial heat. Heat energy from coal costs much less than that from petroleum. Large potential applications include gasification to produce methane, chemical feedstocks, and liquid fuels. Exports of coal are growing and are likely to become an important factor in global economics.

Research on coal has been conducted for more than 100 years. Through most of this century activity in fundamental research has been at a low level. In terms of constant dollars, support for coal research in the United States was about the same in 1970 as it was in 1910. From 1945 to 1973 the coal industry was barely able to exist in competition with petroleum and natural gas. Many of the studies that were conducted in the United States were performed by the Bureau of Mines. Some of that work as well as research elsewhere, notably in Germany, was devoted to efforts to establish general principles about coal, but these were not very successful. A principal reason is the great variability of the material.

Samples of coal derived from many horizons and localities are in some ways different from each other. The sulfur content of coals ranges from 0.2 percent to about 7 percent. The ash fraction varies from a few percent to 30 percent or more. Wide differences are encountered in the chemical nature of the inorganic constituents. Oxygen content ranges from less than 3 percent in an anthracite coal to more than 30 percent in a lignite. These differences reflect variations in the composition of the original organic material, in burial environment, in associated inorganic matter, and in burial history. With the passage of time innumerable chemical reactions occur within the organic matter, leading to complex substances of high molecular weight. Small wonder that most consumption of coal has been by burning it and advances in technology have usually been based on empiricism rather than theory. But in the future, as uses increase, determined efforts will be made to improve the characterization and understanding of coal. In such efforts workers will build on the body of existing knowledge. This knowledge has been compiled by experts in the new book.

This volume (2,395 pages, about 10,000 citations, and 1,000 tables or figures) is the third in a series bearing the title *Chemistry of Coal Utilization*. Its 31 chapters cover the science of coal and the many facets of technology involved in its use. For example, there are chapters on the geology, petrography, physics, and chemistry of coal, and on pyrolysis, combustion, gasification, and liquefaction. Environmental aspects are also treated. The book was prepared by 60 authors and coauthors, all experts in their fields.

As might be expected, the quality of the chapters is not uniform. Some are more tightly written and contain more new information than others. A notable example is a chapter entitled "Coal ash—its effect on combustion systems." A good comprehension of this topic could lead to enhanced reliability of steam boilers and substantial savings of operating and capital costs. A principal blemish of the book is that part of the material in it is outdated. Some authors delivered quickly but others were slow; careful review procedures were also time-consuming, and the large size of the book contributed to delays at the publisher. Nevertheless, this is a uniquely valuable book. It is not for the casual reader, but serious scholars in the field of energy will find it a must.—PHILIP H. ABELSON

**Chemistry of Coal Utilization*. Second supplementary volume. Martin A. Elliott, Ed. (Wiley-Interscience, New York, 1981). $165.