

Analytical
Methods
for Coal
and Coal Products

Edited by
Clarence Karr, Jr.

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Analytical Methods for Coal and Coal Products

Edited by CLARENCE KARR, JR.
Department of Energy
Morgantown Energy Technology Center
Morgantown, West Virginia

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Volume I



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Preface

Because of the inevitable decline in proven world reserves of petroleum and natural gas and the rising world demand for energy and chemical resources, coal has been projected as a major alternative, along with nuclear power, to meet these needs, at least through the year 2000 and probably well beyond. For a considerable period, the next decade or so, the major uses of coal will continue to be combustion in electric power plants and, on a smaller scale, carbonization for the production of metallurgical coke. However, to meet the demands for transportation and other fuels, and petrochemicals, processes such as coal liquefaction will eventually have to play a significant role.

This growing importance of coal has resulted in a renewed interest in the numerous analytical methods for coal and coal products. Many of these are the so-called standard methods (ASTM, ISO, BS, IS, GS, DIN, etc.) that have been periodically updated, but some of which are now found to require modification or reinterpretation to meet new requirements. In addition, there are many relatively new approaches, usually based on modern sophisticated instrumentation, that have been shown to have wide applicability to coal analysis problems but have not all obtained the status of standards. These important new methods require a thorough review and evaluation of their advantages and limitations.

The purpose of these volumes is to present for the first time a work devoted exclusively to many of these analytical problems and methods for coal and most of its numerous products. To this end, in the preparation of these volumes, authors and coauthors from different countries have cooperated to make their expertise, and that of numerous other researchers in review material, available in a single multivolume reference work. Every attempt has been made to cover as much subject matter as feasible in these volumes.

To a considerable extent I have organized these volumes according to some specific coal process such as combustion, carbonization, or liquefaction, the latter included in Volume I. No attempt was made to include discussion of the many different coal processes as such. However, because analytical methods are basically independent of specific

coal processes, there is a large degree of interapplicability, with some modifications or precautions, as indicated in various chapters. Therefore the analyst should seek appropriate methods as much in terms of feeds and gaseous, liquid, and solid products, as in terms of specific coal processes.

Because all coal processes use one or more different types of coal as feed, many details have been presented not only on physical and chemical property determinations, but also on the determinations of trace elements, minerals, and the structure of the organic part of coal. The last subject is of particular significance in the production of either coke or liquid fuels. The first three subjects are covered in Volume I.

Although the use of expensive instrumentation such as x-ray photoelectron spectroscopy, neutron activation analysis, and mass spectrometry instrumentation covered in Volume I, has been growing rapidly in the last decade, as exemplified by the extensive coverage in these volumes, there still exists a very basic need for simple inexpensive equipment that can be assembled and used anywhere in the world that coal is used as a source of energy or materials. This is not only because there are financial constraints on some of the laboratories throughout the world, but also because there sometimes is no modern sophisticated device that can be used to advantage over older established methods. With this in mind, considerable attention has been devoted to the detailed descriptions, such as the methods for sulfur and chlorine described in Volume I, of older techniques, and their modifications, based on the authors' personal experiences in the laboratory. These particular chapters, along with those that go into considerable detail about the latest generation of instruments and techniques, together comprise in essence a handbook of methodology for the analysis of coal and many coal products.

A large number of cross references have been entered to enable the reader to find different approaches to an analytical problem, or to find various applications of the same basic method. Fully detailed entries have been placed in the Index for each volume to enable the reader to find items of specific interest.

I wish to thank all the authors and their organizations for their generous cooperation and support in this venture. I also wish to thank Pamala Kisner Stasia for her assistance with the correspondence involved in the preparation of this work.

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