Fine Coal Processing

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Preface

The availability of relatively cheap energy has been a cornerstone behind the rapid growth, during the twentieth century, in the world's gross global product. Indeed, as individuals, our standards of living are directly related to the cost and availability of energy. Numerous events of the last two decades have shown the vulnerability of the continued assumptions of low-cost and readily available energy. The major sources of energy such as crude oil, natural gas, nuclear reaction, and coal are all being faced with increasing economic, political and environmental pressures.

The world reserve of crude oil resource is expected to be seriously depleted some time in the next century. Consequently, there will be an increasing motivation in upcoming years to move away from the use of crude oil as the major source of energy. Coal is by far the world's largest and most uniformly distributed fossil fuel resource, but economic deposits, by today's standards, may be exhausted sooner than necessary if they are not properly exploited, processed and utilized. The specifications required for different coal uses are becoming increasingly complex. Such specifications can only be met through efficient processing. Factors such as ash content, volatile matter, particle size, coking properties, sulfur content, etc., have controlling influences on the ultimate uses of coal. These factors are a direct consequence of efficient methods of gangue liberation and its removal by appropriate processing techniques. Careful process design and process optimization are keys to meet the various market requirements.

With the drive towards reducing the overall mining economics, the modern trend of intensive mechanization and non-selective mining have increased the production of fines (-500 micrometers). Depending on various geological and operational factors the fines content in the run of mine coal can vary between 10 to 35 weight percent. These fines not only form a significant proportion

of processing plant feed, they also contain economic amounts of the desirable carbonaceous component required in specific coal markets. Their elimination can also adversely influence the chance of meeting selected market specifications. Consequently for such marginal coal, the optimization of fine coal processing plays a critical economic role.

Fine coal processing has been considered a major problem for some time. Compared to coarse fractions it is more expensive to treat fines. Various processes have been developed based on the physical and the physico-chemical properties of coal and the associated gangue minerals. Some of them have achieved significant commercial success. There have also been attempts to integrate the technologies of mineral, ore and coal processing, as the former has achieved relatively more sophistication. With the increasing economic significance of coal, coal processing is also attracting increasing research and development resources.

Processes based on the relative density differential between coal and associated gangue minerals, such as tables, spirals, sluices and water washing cyclones are frequently used for treating fine coal. However, froth flotation remains the most effective method of fine coal processing, though other surface chemical processes such as selective flocculation and agglomeration have received attention in recent years. The problems associated with fine coal flotation have presented many challenges to process engineers. Factors such as surface oxidation, clay slime content, fine particle size, and sulfur content are considered to be major problems in various parts of the world. Development of suitably designed flotation reagents, proper instrumentation and process control are leading towards the improved recovery of coal. The circuit yield is further improved through efficient dewatering of the froth concentrate.

To our knowledge, there is no book which is exclusively devoted to the subject of fine coal processing. The subject is complex and it is difficult to justify full and detailed coverage of every subject in a volume of this size. Our objective is to provide a self-contained introduction to current technology. It is expected that this book would be useful to students, practicing process engineers, chemical and equipment suppliers and researchers working in the field of coal process engineering. We have been fortunate in being able to secure the collaboration of a team of authors who have been major contributors in the field of fine coal processing for many years.

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