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Preface

CO_2 Sequestration in Coals and Enhanced Coalbed Methane Recovery

Carbon dioxide (CO_2) sequestration in coal and enhanced coalbed methane recovery (ECBM) during injection of carbon dioxide have recently become a vibrant research area due to its potential for permanently storing carbon dioxide in deep and unminable coal seams while producing methane to offset the costs. The field applications of this technology have been demonstrated in North America, Asia and Europe in medium- to large-scale field tests. Future smaller scale demonstration tests are also being planned in different countries to further explore the potential of the technology to reduce atmospheric CO_2 levels and to investigate various operational problems and unexpected outcomes that have been encountered in the previous field tests.

The operational problems encountered during coal seam CO_2 sequestration are largely due to the heterogeneous nature of coal and the interactions of gases with different structural and chemical features of the coal. It has been concluded that these interactions change the reservoir behavior of coal seams as well as fluid flow and storage characteristics. The general consensus among geologists, engineers and coal scientists working on different aspects of CO_2 sequestration is that there is a lack of adequate understanding of how coal–gas interactions can change reservoir and flow behavior and how better analytical and numerically methods can be developed to characterize these changes.

The objective of this special issue on "CO_2 sequestration in coals and enhanced coalbed methane recovery" was to bring together the latest research and application results on this topic. We are also hoping that this issue is going to create a medium where engineers and scientists around the world will become more familiar with each other's work to develop collaborative research ideas.

The contents of papers included in this issue span from coal–gas interactions to various measurement methods on macro and micro scale, from laboratory measurements to results of field-scale tests, and from theoretical developments of gas sorption and flow to simulation studies of prospective coal seams for CO_2 sequestration. In that regard, the order of papers published in this issue is: coal gas interactions, modeling studies, macro-scale reservoir simulations, and economics of CO_2 sequestration.

This issue contains 24 papers. The first 5 papers deal with the basic science and studies on the coal–gas interaction, the causes and consequences of errors in determining sorption capacity, the kinetics of sorption for gas mixtures in coal and the imbibition and wettability characteristics of coal as a reservoir. The next seven papers are concentrated on the novel instrumental techniques, such as SAXS, SANS, acoustic emission, x-ray micro tomography, optical imaging and pressure transient techniques that can be used to characterize gas sorption mechanisms, their kinetics, the resultant strains and the permeability of coal. Permeability change in coals due to gas sorption is certainly one of the major issues related to field applications. In the 13th and 14th papers of, this issue is discussed with examples and improved analytical modeling approaches. These papers are followed by two papers (15th and 16th), which deal with the numerical formulation issues of gas sorption and transport in coal micro-structure and with the modeling issues of CO_2 sequestration and enhanced coalbed methane recovery. The next group of papers (17th and 18th) is on parametric simulations on two different coal fields: Huntly field in New Zealand and Zonguldak Basin in Turkey. Beside the difference in coalfield, these studies used two different simulators for evaluations of methane production and CO_2 injection. These are followed by three papers (19th–21st) that evaluate the results of two actual field tests (in Europe and in the U.S.) and the assessment of coal swelling and shrinkage based on rank-dependent properties of coals. In the last three papers of this issue, a study to improve CO_2 injectivity in a coal reservoir, a new model coupling of flow and geomechanics of coals, and the economics of CO_2 sequestration are presented.

We, as guest editors, enjoyed putting together this issue. We thank Dr. Jim Hower for giving this opportunity to us and thank Theresa Wiley who was always responsive to our logistical needs and who made it possible to produce this issue on time. But we would especially like to thank all the authors and co-authors for their important contributions to this issue and for making all the deadlines despite their busy schedules. We also thank all the reviewers who granted our requests to review these papers in timely manners. They contributed immensely to the quality of the papers through their insightful comments and suggestions.

We hope this issue will be a valuable contribution meeting the needs of the scientific community, will promote collaborative research activities, and ultimately will help the advancement of science and technology of CO_2 sequestration in coals and enhanced coalbed methane recovery. We hope that you will like and enjoy this issue as much as we do.

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