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Gregory J. McCarthy and Robert J. Lauf

Frontmatter

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Frontmatter

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Frontmatter

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EDITORS:

Gregory J. McCarthy

North Dakota State University, Fargo, North Dakota, U. S. A.

Robert J. Lauf

Oak Ridge National Laboratory, Oak Ridge, Tennessee, U. S. A.



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Frontmatter

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Frontmatter

[More information](#)

Contents

PREFACE	xi
PART I: FLY ASH CHARACTERIZATION	
CHARACTERIZATION OF FLY ASH AND ITS REACTIONS IN CONCRETE Della M. Roy, Karen Luke and Sidney Diamond	3
TRANSMITTED AND REFLECTED VISIBLE LIGHT MICROSCOPY OF TWO BITUMINOUS FLY ASHES Donald L. Biggs and Joseph J. Bruns	21
SCANNING ELECTRON MICROSCOPY AND X-RAY DIFFRACTION ANALYSIS OF VARIOUS SIZE FRACTIONS OF FLY ASH R.C. Joshi, G.S. Natt, R.L. Day and D.D. Tilleman	31
ELECTROKINETIC PHENOMENA AND SURFACE CHARACTERISTICS OF FLY ASH PARTICLES R.A.I. Malek and D.M. Roy	41
TECHNICAL NOTE ON THE DETERMINATION OF FREE LIME (CaO) IN FLY ASH Scott Schlorholtz and Turgut Demirel	51
CHARACTERIZATION OF CRYSTALLINE PHASES IN FLY ASH BY MICROFOCUS RAMAN SPECTROSCOPY Barry E. Scheetz and William B. White	53
CHARACTERIZATION OF CATALYZED DEVITRIFICATION IN QUENCHED FLY ASH MELTS Subhash H. Risbud	61
PART II: UTILIZATION OF FLY ASH	
RETARDATION EFFECTS IN THE HYDRATION OF CEMENT-FLY ASH PASTES Michael W. Grutzeck, Wei Fajun and Della M. Roy	65
REACTION PRODUCTS IN FLY ASH CONCRETE Mark D. Baker and Joakim G. Laguros	73
AUTOCLAVE EXPANSION OF PORTLAND CEMENT-FLY ASH PASTES Scott Schlorholtz and Turgut Demirel	85
EFFECTS OF FLY ASH AND SUPERPLASTICIZERS ON THE RHEOLOGY OF CEMENT SLURRIES Elizabeth L. White, Maria Lenkei, Della M. Roy and Ferenc D. Tamás	95

Cambridge University Press

978-1-107-40567-7 - Fly Ash and Coal Conversion By-Products Characterization, Utilization, and Disposal: Symposium held November 29-30, 1984, Boston, Massachusetts, U. S. A.

Gregory J. McCarthy and Robert J. Lauf

Frontmatter

[More information](#)

FLEXURAL STRENGTH AND FRACTURE PROPERTIES OF A FLY ASH BLENDED CEMENT S. Chanda and J.E. Bailey	107
PROPERTIES AND POTENTIAL USES OF THE PRODUCTS RESULTING FROM THE FLUIDISED BED COMBUSTION OF COAL WASHERY WASTES Denis G. Montgomery	119
UTILIZATION OF FLY ASH IN ROADBED STABILIZATION: SOME EXAMPLES OF WESTERN U.S. EXPERIENCE Oscar E. Manz and Bradley A. Manz	129
UTILIZATION OF FLY ASH IN OIL AND GAS WELL CEMENTING APPLICATIONS Asok K. Sarkar	141
POTENTIAL RESOURCES FROM COAL FLY ASH J.S. Watson	151

PART III: COAL GASIFICATION ASH

CHARACTERIZATION OF A LIGNITE ASH FROM THE METC GASIFIER I. MINERALOGY Gregory J. McCarthy, Lindsay P. Keller, Robert J. Stevenson, Kevin C. Galbreath and Aaron L. Steinwand	165
CHARACTERIZATION OF A LIGNITE ASH FROM THE METC GASIFIER II. SCANNING ELECTRON MICROSCOPY R.J. Stevenson and R.A. Larsen	177
CHARACTERIZATION OF A LIGNITE ASH FROM THE METC GASIFIER III. CORRELATIONS OF LEACHING BEHAVIOR AND MINERALOGY D.J. Hassett, G.J. McCarthy, K.R. Henke and E.D. Korynta	187
COMPARATIVE ECONOMICS OF SEVERAL ALTERNATIVES FOR BULK UTILIZATION OF FLY ASH AND COAL GASIFICATION ASH D.E. Severson, O.E. Manz and M.J. Mitchell	195

PART IV: ENVIRONMENTAL CONSIDERATIONS

DISPOSAL OF WESTERN FLY ASH IN THE NORTHERN GREAT PLAINS Gerald H. Groenewold, David J. Hassett, Robert D. Koob and Oscar E. Manz	213
MOBILITY OF ORGANIC AND INORGANIC CONSTITUENTS FROM ENERGY AND COMBUSTION-RELATED WASTES UNDER CODISPOSAL CONDITIONS M.P. Maskarinec, C.W. Francis and J.C. Goyert	227

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Gregory J. McCarthy and Robert J. Lauf
Frontmatter
[More information](#)

INVESTIGATION OF LEACHABILITY OF SUBBITUMINOUS FLY ASH ENHANCED ROAD BASE MATERIALS Ivan Garcez and Marty E. Tittlebaum	237
TECHNICAL REVIEW OF THE ENERGY AUTHORITY COAL WASTE ARTIFICIAL REEF PROGRAM (C-WARP) C.A. Hornibrook and J.H. Parker	249
AUTHOR INDEX	269
SUBJECT INDEX	271

Cambridge University Press

978-1-107-40567-7 - Fly Ash and Coal Conversion By-Products Characterization, Utilization, and Disposal: Symposium held November 29-30, 1984, Boston, Massachusetts, U. S. A.

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Frontmatter

[More information](#)

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Frontmatter

[More information](#)

Preface

Vast quantities of inorganic by-products are produced when coal is burned or gasified. In the United States, nearly 60 million tons of fly ash is removed from power plant stacks each year and more than 80% of this ash is buried in landfills or stored in holding ponds pending burial. Only 10% has found a commercial market, chiefly as in concrete-related uses. Conversion of coal to other energy sources will lead to additional large quantities of ash in the future. In 1984, the first commercial US coal gasification plant opened in North Dakota. The 1100 tons of ash produced each day is being buried in the nearby strip mine. With such vast quantities of ash involved, one needs to be attuned to any environmental consequences of burying ash and to any new possibilities of using this vast resource for industrial or civil engineering applications. Thorough characterization of the ash materials and their reactions provides the scientific basis of safe disposal or effective utilization. This volume brings together peer-reviewed papers on characterization, utilization and disposal of coal fly ash and gasification ash.

The papers in this volume are based on presentations in Symposium M of the 1984 Fall Meeting of the Materials Research Society. This was the the Society's third symposium on the subject of ash characterization and utilization. Proceedings of the first were published under the title "Effects of Fly Ash Incorporation in Cement and Concrete," edited by Sidney Diamond. Copies of these proceedings are available from D. M. Roy of Penn State's Materials Research Laboratory. Relevant papers from the second symposium, edited by G. J. McCarthy, appeared in the July 1984 issue of Cement and Concrete Research. The Society will hold a fourth symposium on this subject in 1985 and the proceedings will be published as Volume II under the title of this book.

The state of the art in the characterization of fly ash and fly ash-containing mortars and concrete is the subject of the keynote paper prepared by Professor Della M. Roy of Penn State University. X-ray diffraction, scanning electron microscopy and thermal analysis are most often employed in characterizing these materials and their reactions. These techniques are highlighted in many of the papers that follow, along with other methods ranging from time-honored petrographic microscopy and metallography to the first results to be obtained from the new microfocus laser Raman instruments.

Utilization research presented here includes the well-established replacement of some of the cement in concrete by fly ash as well as roadbed stabilization and oil and gas well cementing applications. Characterization and potential uses for gasification ash are presented by scientists and engineers from the North Dakota universities. Processes that employ coal ash as a source of aluminum are discussed in a paper from the Oak Ridge National Laboratory. While not economical at present, coal ash could become a principal Al source in case of any future bauxite shortage.

Environmental concerns in use of fly ash for roadbed stabilization and in burial of fly ash in reclaimed strip mines and municipal landfills are addressed in the final section of this volume. The formation from coal waste of an artificial reef described by Hornibrook and Parker is an innovative combination of utilization and disposal.

It is hoped that this volume, combined with the previous two proceedings, will provide the interested reader with up-to-date information on coal

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Frontmatter

[More information](#)

combustion and conversion by-products with a distinct materials science and engineering flavor.

R. J. Lauf and I would like to acknowledge the financial and logistical support provided by the Chemistry Department at North Dakota State University and by Oak Ridge National Laboratory in preparing this volume. In organizing the Symposium we had the invaluable assistance of Professors Turgut Demirel of Iowa State and Barry E. Scheetz of Penn State. We are also grateful to the Tennessee Valley Authority for a grant that helped to make publication of these proceedings possible.

G. J. McCarthy
Fargo, North Dakota
February, 1985