

CONTENTS

Foreword	ix
Acknowledgements	xi
1. INTRODUCTION	1
2. COAL QUALITY AND ANALYSIS	
2.1 Coal quality parameters	17
2.2 Sampling and sample preparation	42
2.3 Moisture in coal	55
2.4 Coal porosity	75
3. ORGANIC STRUCTURE	
3.1 Molecular structure	93
3.2 Petrographic model	114
3.3 Rank and maceral effects on composition and properties	145
3.4 Sources of variation in rank and maceral composition	167
4. HETEROATOMS AND INORGANIC IMPURITIES	
4.1 Sulphur	185
4.2 Nitrogen	206
4.3 Mineral matter	213
5. PULVERISATION	
5.1 Size reduction	243
5.2 Grindability tests	250
5.3 The prediction of mill performance	275
5.4 Utility scale mill performance	275
5.5 Abrasion	288
6. PYROLYSIS	
6.1 Char formation	297
6.2 Internal microstructure of chars	323
7. CHAR OXIDATION	
7.1 High-temperature oxidation	339
7.2 Thermogravimetric techniques	350
7.3 Maceral influences on high-temperature oxidation	365
8. CARBON BURN-OUT	
8.1 Carbon burn-out model	381
8.2 Burn-out calculations	393
8.3 Full-scale validation of the burn-out model	398
9. FLAME STABILITY	
9.1 Development of a model for flame stability	409
9.2 Ranking of coal flame stability	426

9.3 Flame stability characteristics in a test furnace	433
9.4 Sensitivity of model predictions	449
10. COAL QUALITY EFFECTS ON BOILER OPERATION AND POLLUTANT EMISSIONS	
10.1 Conversion of minerals to ash	461
10.2 Slagging and fouling problems in utility boilers	469
10.3 Atmospheric emissions	473
11. PREDICTION OF ASH DEPOSITION BY COMBUSTION TESTS	
11.1 Small-scale combustion testing	493
11.2 Formation and removal of furnace wall deposits	501
11.3 Formation and removal of compatibilities tube deposits	537
12. ULTRA-FINE COAL AS AN OPTION FOR INDUSTRIAL BOILERS	
12.1 Fuel and boiler compatibilities	555
12.2 Test combustor trials	559
12.3 Prediction of industrial boiler performance	570
13. THE FATE OF FLY ASH, NITROGEN AND SULPHUR	
13.1 Ash capture and emissions	575
13.2 The influence of coal properties on Nox emissions	579
13.3 The fate of sulphur during combustion	591
Appendix 1. analytical details and origin of coals used in our studies	600
Appendix 2. List of abbreviations	603
Author Index	661
Subject Index	621