



# Contents

|          |  |            |
|----------|--|------------|
| <b>1</b> | <b>Introduction</b>  | <b>1</b>   |
| <b>2</b> | <b>Experimental Techniques</b>   | <b>3</b>   |
| 2.1      | Production of Energetic Atoms  | 3          |
| 2.2      | Radiochemical Separation Techniques                                    | 11         |
| 2.2.1    | Gas Phase: Radiogas Chromatography                                     | 11         |
| 2.2.2    | Condensed Phase  | 17         |
| 2.3      | Special Physical Techniques  | 22         |
| 2.3.1    | Special Physical Techniques in Gas Phase Studies — Charge Spectrometry | 22         |
| 2.3.2    | Special Physical Techniques for Condensed Phase Studies                | 27         |
| <b>3</b> | <b>Characteristics of Hot Atom Reactions</b>                           | <b>32</b>  |
| 3.1      | Gas Phase Hot Atom Reactions   | 32         |
| 3.1.1    | Theoretical Background   | 32         |
| 3.1.2    | Gas Phase Hot Atom Reactions   | 41         |
| 3.1.3    | Tritium  | 46         |
| 3.1.4    | Fluorine   | 56         |
| 3.1.5    | Chlorine   | 60         |
| 3.1.6    | Bromine  | 63         |
| 3.1.7    | Iodine   | 66         |
| 3.1.8    | Carbon   | 69         |
| 3.1.9    | Other Multivalent Elements   | 73         |
| 3.2      | Liquid Phase Hot Atom Reactions  | 81         |
| 3.2.1    | Organic Condensed Phase  | 81         |
| 3.2.2    | Inorganic Liquid Systems   | 87         |
| 3.3      | Solid Phase Hot Atom Reactions   | 98         |
| <b>4</b> | <b>Applications of Hot Atom Chemistry and Related Topics</b>           | <b>111</b> |
| 4.1      | Applications in Inorganic, Analytical and Geochemistry                 | 111        |
| 4.1.1    | Applications in Inorganic and Analytical Chemistry                     | 111        |
| 4.1.2    | Applications and Related Topics in Geochemistry                        | 116        |
| 4.2      | Applications in Physical Chemistry                                     | 118        |

VIII Contents

|                                |  |            |
|--------------------------------|--|------------|
| 4.3                            | Applications in Biochemistry and Nuclear Medicine .                        | 124        |
| 4.4                            | Hot Atom Chemistry in Energy-Related Research. .                           | 133        |
| 4.5                            | Current Topics Related to Hot Atom Chemistry<br>and Future Scope . . . . . | 144        |
| <b>Subject Index . . . . .</b> |  | <b>153</b> |