

Contents

List of Contributors v

Preface xv

Chapter 1 Historical Development of Hot Atom Chemistry and Prospects

1.1 Outline of History (A. G. Maddock)	3
1.2 Hot Atom Chemistry of Naturally Occurring Radionuclides (M. Sakanoue)	17
1.3 Early Nuclear Hot Atom Chemistry (J. E. Willard)	21
1.4 Discovery of New Elements and Hot Atom Chemistry (D. C. Hoffman)	27

Chapter 2 Hot Atom Chemistry of Specific Elements

2.1 Hot Atom Chemistry of Tritium (Y. Aratono, K. Oohashi and D. S. Urch)	35
2.2 Hot Atom Chemistry of Chlorine (G. A. Brinkman and B. S. M. Rao)	41
2.3 Hot Atom Chemistry of Bromine (G. A. Brinkman and B. S. M. Rao)	57
2.4 Hot Atom Chemistry of Iodine (E. P. Rack)	66
2.5 Hot Atom Chemistry of Astatine (K. Berei and L. Vasáros)	80
2.6 Hot Atom Chemistry of Carbon and Silicon (P. P. Gaspar)	85
2.7 Hot Atom Chemistry of Nitrogen (Y. Sensui and M. J. Welch)	105
2.8 Hot Atom Chemistry of Oxygen (R. A. Ferrieri)	114
2.9 Hot Atom Chemistry of Sulphur (K. Niisawa and K. Taki)	126

Chapter 3 Fundamentals of Hot Atom Chemistry

3.1 Molecular Beam Studies and Hot Atom Chemistry (R. E. Continetti and Y. T. Lee)	133
3.2 Energy Transfer Processes and Retention of Hot Atoms (R. E. Johnson, M. Liu, R. A. Baragiola and J. W. Boring)	156
3.3 Collisional De-excitation of Excited Rare Gas Atoms in the Metastable and Resonant States (Y. Hatano)	167
3.4 Stereo Organic Hot Atom Chemistry (R. A. Ferrieri, A. P. Wolf and E. P. Rack)	176
3.5 Theoretical Approaches to the Hot Atom Chemistry of Hydrogen (T. Valencich)	188
3.6 Nonequilibrium Time Dependent Theory of Hot Atom Reactions (K. Koura and B. Shizgal)	210

3.7	Bimolecular Hot Chemistry Reaction Rates in Gas Phases (M. Heyl and K. Roessler)	226
3.8	Muonium Hot Atom Chemistry (M. Senba, D. J. Arseneau and D. G. Fleming)	232
3.9	Random Walk Theory and Hot Atom Chemistry (K. Funabashi)	247
3.10	RRKM- and Non-RRKM Behavior in Gas-Phase Reactions (Y. Sakai)	257

Chapter 4 Hot Atom Chemical Processes in Condensed Phase

4.1	Computer Simulation of Collision Cascades in Solids (K. Roessler)	265
4.2	Hot Atom Chemistry of Organic Liquids (K. Berei)	286
4.3	Primary Retention, Recoil Energy Spectra and Appearance Energy (T. Matsuura and K. Sasaki)	305
4.4	Annealing Studies (C. H. Collins, S. Bulbulian and A. G. Maddock)	320
4.5	Exchange Reactions in Solids (G. Duplâtre)	334
4.6	Chemical Reaction Induced by Recoil Implanted Atoms (K. Yoshihara and T. Sekine)	344
4.7	Hot Atom Chemistry of Single Crystals (G. W. A. Newton)	351
4.8	Hot Atom Chemistry of Mixed Crystals and Mixed Ligand Coordination Compounds (H. Mueller and H. Shoji)	354
4.9	Production of Radionuclides Using Hot Atom Chemistry (H. Ebihara and K. E. Collins)	378
4.10	Hot Atom Chemistry and Activation Analysis (E.P. Rack and A. J. Blotcky)	383

Chapter 5 Radiation-Chemical and Other Hot Atom Chemistry Related Processes

5.1	Comparison of Recoil T Atoms with H(D) Atoms Produced by Radiolysis and Photolysis in the Solid Phase (T. Miyazaki)	395
5.2	On Solvated Electrons in Condensed Phase (M. Ogasawara)	402
5.3	Scavenger Reaction in Hot Atom Chemistry and Radiation Chemistry (S. Ohno and Y. Aratono)	412
5.4	Theoretical Study on Tritium Decay (S. Ikuta and M. Imamura)	419
5.5	Luminescence from Irradiated Materials (H. J. Arnikar, S. F. Patil and T. Hashimoto)	423
5.6	Linear Energy Transfer (LET) Effects of Radiation Chemistry (M. Imamura)	434
5.7	α -Recoil Damage and Hot Atom Chemistry (T. Hashimoto)	443
5.8	Radiation Damage of Solids (N. Itoh)	449
5.9	Theory of Sputtering (R. E. Johnson, J. W. Boring and R. Baragiola)	461

Chapter 6 Relation to Other Nuclear Techniques

6.1	Moessbauer Spectroscopy Applied to Hot Atom Chemistry (K. Endo and H. Sano)	473
6.2	Hot Atom Chemistry and Positronium Chemistry (Y. Ito, E. Lazzarini and H. J. Ache)	488
6.3	Chemical Effects in Nuclear Decay Processes: Applications in Hot Atom Chemistry (D. S. Urch)	500
6.4	PAC Techniques to Study Chemical Effects of Nuclear Transformations (K. Yoshihara and H. Kaji)	506

Chapter 7 Correlation with Life-, Geo-, and Space Sciences

7.1	Practical Production of Simple Positron Emitting Compounds by Hot Atom Chemical Method (R. Iwata and A. P. Wolf)	515
7.2	β -Decay Effects of Tritium Incorporated in Organic Molecules and Living Matter (T. Asano)	533
7.3	Molecular Consequences of the Auger Effect (A. Halpern)	550
7.4	Geochemistry and Hot Atom Chemistry (J.-P. Adloff and K. Roessler)	571
7.5	The Oklo Phenomenon, Isotopic Anomaly and Hot Atom Chemistry (P. K. Kuroda)	584
7.6	Hot Atom Chemical Processes in Space (K. Roessler)	601

Chapter 8 Hot Atom Chemistry and Energy and Environmental Problems

8.1	Hot Atom Chemistry of Radon and its Progeny (J.-P. Adloff)	627
8.2	Hot Atom Chemistry and Severe Accident of Water Cooled Fission Reactor (M. Saeki)	637
8.3	Fusion Reactor and Hot Atom Chemistry (H. Kudo)	647
8.4	Utilization of Radioactive Decay and Hot Atom (Y. Aratono and S. Ohno)	663

Author Index	671
Subject Index	688
Acknowledgements	699