

FLUID FUEL REACTORS

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FOREWORD

The customary approach to reactor development assumes that a reactor is primarily a mechanical engineering device—that the ultimate goal of economically competitive nuclear power will be achieved by simplifying the mechanical design and by making the fuel elements more reliable. The other, basically different, view of reactor technology holds that reactors are chemical plants—that the methods which have proved so useful in rationalizing the chemical industry, i.e., the continuous handling of materials in liquid form, should lead to ultimate economies in reactor plants. This “chemical” approach to reactors has been pursued vigorously in the United States for almost a decade; it is summarized in this volume on fluid fuel reactors.

The basic simplicity of the liquid reactor—the original idea of “a pot, pump, and pipe”—has hardly persisted throughout the years. Those who have actually built and operated high-temperature, high-powered liquid reactors have become impressed with their difficulty—the difficulty primarily of handling vast amounts of radioactivity in labile form. It seems now that liquid reactor systems, when reduced to practice, are in many ways more complicated than their solid competitors; at least their complications (being in the plumbing system) are much more obtrusive than the complications of a solid fuel reactor, which lie out of sight in the core.

Yet in spite of their difficulties, the two underlying motivations for liquid and other fluid systems remain: their fuel cycle is simpler and their neutron economy is better than for solid-fueled reactors. Thus there continues to be strong incentive to develop these systems. It is the belief of fluid fuel enthusiasts that in the very long run the simplification in fuel cycle and, more important, the better neutron economy made possible by the use of fluid fuels will outweigh the difficult handling problems and ultimately weight the balance of reactor development toward these systems.

The present volume contains a summary of the work done in the United States on fluid fuel reactors. The first part deals with the aqueous homogeneous reactor; most of this work has been done at the Oak Ridge National Laboratory, with some phases of the work (on slurries) at Westinghouse Atomic Power Division and some work on phosphate solutions at Los Alamos Scientific Laboratory. The second part deals with the fused salt system, which has been investigated primarily at the Oak Ridge Laboratory; the third part deals with the bismuth-uranium system, investigated at Brookhaven National Laboratory.

It is my hope that the results described here will be helpful to all who are interested in fluid fuel systems, and that, by disseminating this information, new ideas and new approaches will be generated to help solve the remaining problems of fluid fuel reactors.

Oak Ridge, Tenn.
June 1958

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EDITORS' NOTE

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The data selected, its evaluation, and the conclusions reached in this book are wholly the work of the authors, contributors, and editors.

June 1958

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CONTENTS

PART I. AQUEOUS HOMOGENEOUS REACTORS

CHAPTER 1. HOMOGENEOUS REACTORS AND THEIR DEVELOPMENT . . .	1
1-1. Background	1
1-1.1 Work prior to the Manhattan Project	1
1-1.2 Early homogeneous reactor development programs at Columbia and Chicago universities	2
1-1.3 The first homogeneous reactors and the Los Alamos program	4
1-1.4 Early homogeneous reactor development at Clinton Laboratories (now Oak Ridge National Laboratory) . .	6
1-1.5 The homogeneous reactor program at the Oak Ridge National Laboratory	7
1-1.6 Industrial participation in homogeneous reactor devel- opment	9
1-2. General Characteristics of Homogeneous Reactors	11
1-2.1 Types of systems and their applications	11
1-2.2 Advantages and disadvantages of aqueous fuel systems .	13
1-3. U ²³⁵ Burner Reactors	17
1-3.1 Dilute solution systems and their applications	17
1-3.2 High-temperature systems	17
1-4. Converter Reactors	18
1-4.1 Purpose of converters	18
1-4.2 One-region converters	18
1-4.3 Two-region converters	19
1-5. Breeder Reactors	19
1-5.1 The importance of breeding	19
1-5.2 One-region thorium breeders	20
1-5.3 Two-region breeder reactors	20
1-6. Miscellaneous Homogeneous Types	21
1-6.1 Boiling reactors	21
1-6.2 Gaseous homogeneous reactors	23
1-6.3 Fluidized systems	24
CHAPTER 2. NUCLEAR CHARACTERISTICS OF ONE- AND TWO-REGION HO- MOGENEOUS REACTORS	29
2-1. Criticality Calculations	29
2-1.1 Calculation methods	30
2-1.2 Results obtained for one-region reactors	33
2-1.3 Results obtained for two-region reactors	36
2-2. Nuclear Constants Used in Criticality Calculations	39

2-2.1	Nuclear data	41
2-2.2	Resonance integrals	43
2-3.	Fuel Concentrations and Breeding Ratios under Initial and Steady-State Conditions	43
2-3.1	Two-region reactors	44
2-3.2	Two-region thorium breeder reactors evaluated under initial conditions	44
2-3.3	Nuclear characteristics of two-region thorium breeder reactors under equilibrium conditions	50
2-3.4	Equilibrium results for two-region uranium-plutonium reactors	56
2-3.5	One-region reactors	57
2-3.6	Equilibrium results for one-region thorium breeder reactors	58
2-3.7	Equilibrium results for one-region uranium-plutonium reactors	59
2-4.	Unsteady-State Fuel Concentrations and Breeding Ratios	59
2-4.1	Two-region reactors	59
2-4.2	One-region reactors	66
2-5.	Safety and Stability of Homogeneous Reactors Following Reactivity Additions	67
2-5.1	Homogeneous reactor safety	67
2-5.2	Homogeneous reactor stability	77
CHAPTER 3.	PROPERTIES OF AQUEOUS FUEL SOLUTIONS	85
3-1.	Introduction	85
3-2.	Solubility Relationships of Fissile and Fertile Materials	85
3-2.1	General	85
3-2.2	Uranyl sulfate	87
3-2.3	Other uranium compounds	93
3-2.4	Solubilities of nonuranium compounds	98
3-3.	Radiation Effects	101
3-3.1	Introduction	101
3-3.2	Primary and secondary reactions in pure water	102
3-3.3	Decomposition of water in uranium solutions	104
3-3.4	Recombination in uranium solutions	107
3-3.5	Peroxide decomposition in uranium solutions	108
3-3.6	Decomposition of water in thorium solutions	111
3-4.	Physical Properties	111
3-4.1	Introduction	111
3-4.2	Density of heavy water and uranyl sulfate solutions	113
3-4.3	Viscosity of D ₂ O and uranium solutions	114
3-4.4	Heat capacity of uranyl sulfate solutions	115
3-4.5	Vapor pressure of uranyl sulfate solutions	115
3-4.6	Surface tension of uranyl sulfate solutions	116
3-4.7	Hydrogen ion concentration (pH)	119
3-4.8	Solubility of gases	120
3-4.9	Reaction limits and pressures	120

CHAPTER 4. TECHNOLOGY OF AQUEOUS SUSPENSIONS	128
4-1. Suspensions and Their Applications in Reactors	128
4-1.1 Introduction	128
4-1.2 Types of suspensions and their settled beds	129
4-1.3 Engineering problems associated with colloidal properties	130
4-1.4 Engineering problems not associated with colloidal properties	132
4-1.5 Systems and components for using slurries in reactors	134
4-2. Uranium Oxide Slurries	135
4-2.1 Introduction	135
4-2.2 Chemical stability of uranium oxides	135
4-2.3 Crystal chemistry of UO_3	136
4-2.4 $\text{UO}_3 \cdot \text{H}_2\text{O}$ slurry characteristics	139
4-2.5 Zero-power reactor tests	139
4-3. Preparation and Characterization of Thorium Oxide and Its Aqueous Suspensions	139
4-3.1 Selected properties of thorium oxide	139
4-3.2 Preparation of thorium oxide	140
4-3.3 Large-scale preparation of thorium oxide	141
4-3.4 Characterization of thorium oxide products	143
4-3.5 Sedimentation characteristics of thorium oxide slurries	149
4-3.6 Status of laboratory development of thorium oxide slurries	158
4-4. Engineering Properties	158
4-4.1 Introduction	158
4-4.2 Physical properties	160
4-4.3 Fluid flow	168
4-4.4 Hindered-settling systematics	171
4-4.5 Heat transfer	173
4-5. Operating Experience with the HRE-2 Slurry Blanket Test Facility	176
4-5.1 Introduction	176
4-5.2 Operation of blanket pressure vessel mockup system	177
4-6. Radiation Stability of Thorium Oxide Slurries	179
4-6.1 Introduction	179
4-6.2 Experimental technique	180
4-6.3 Irradiation results	181
4-7. Catalytic Recombination of Radiolytic Gases in Aqueous Thorium Oxide Slurries	183
4-7.1 Introduction	183
4-7.2 Experimental techniques and method of analysis	184
4-7.3 Catalytic activity of thorium and thorium-uranium oxide slurries	185
4-7.4 Survey of possible catalysts	185
4-7.5 Molybdenum oxide as a catalyst	186
4-7.6 In-pile studies	188

CHAPTER 5. INTEGRITY OF METALS IN HOMOGENEOUS REACTOR MEDIA	198
5-1. Introduction	198
5-2. Experimental Equipment for Determining Corrosion Rates	199
5-2.1 Out-of-pile equipment	199
5-2.2 In-pile equipment	205
5-3. Survey of Materials	211
5-3.1 Introduction	211
5-3.2 Corrosion tests in uranyl carbonate solutions	211
5-3.3 Corrosion tests in uranyl fluoride solutions	213
5-3.4 Corrosion tests in uranyl sulfate solutions	215
5-3.5 Conclusions	218
5-4. Corrosion of Type-347 Stainless Steel in Uranyl Sulfate Solutions	219
5-4.1 Introduction	219
5-4.2 Effect of temperature	219
5-4.3 Effect of solution flow rate	220
5-4.4 Effect of uranyl sulfate and sulfuric acid concentration	222
5-4.5 Temperature dependence of flow effects	223
5-4.6 Effect of corrosion inhibitors	224
5-4.7 Qualitative mechanism of the corrosion of stainless steel in uranyl sulfate solutions	226
5-4.8 Radiation effects	229
5-5. Radiation-Induced Corrosion of Zircaloy-2 and Zirconium	232
5-5.1 Introduction	232
5-5.2 Corrosion of Zircaloy-2 and zirconium in uranyl sulfate solutions in the absence of radiation	233
5-5.3 Methods and procedures employed with in-pile tests	234
5-5.4 Results of in-pile tests with Zircaloy-2 and zirconium	237
5-5.5 Tests of the effect of fast-electron irradiation on Zircaloy-2 corrosion	242
5-5.6 Discussion of results of radiation corrosion experiments	242
5-6. Corrosion Behavior of Titanium and Titanium Alloys in Uranyl Sulfate Solutions	245
5-6.1 Introduction	245
5-6.2 Corrosion of titanium and titanium alloys in uranyl sulfate solutions in the absence of radiation	246
5-6.3 Corrosion of titanium and titanium alloys in uranyl sulfate solution under irradiation	246
5-7. Aqueous Slurry Corrosion	248
5-7.1 Nature of attack	248
5-7.2 Slurry materials	254
5-7.3 Effect of slurry characteristics	256
5-7.4 Effect of operation conditions	260
5-7.5 Radiation	262
5-8. Homogeneous Reactor Metallurgy	262
5-8.1 Introduction	262
5-8.2 Fabrication and morphology of Zircaloy-2	263
5-8.3 Mechanical properties of zirconium and titanium	266
5-8.4 Welding of titanium and zirconium	271

5-8.5	Combustion of zirconium and titanium	275
5-8.6	Development of new zirconium alloys	276
5-8.7	Inspection of metals by nondestructive testing methods	278
5-8.8	Radiation effects in pressure vessel steels	279
5-9.	Stress-Corrosion Cracking	283
5-9.1	Introduction	283
5-9.2	Fuel systems	284
5-9.3	Slurry systems	289
5-9.4	Secondary systems	289
CHAPTER 6.	CHEMICAL PROCESSING	301
6-1.	Introduction	301
6-2.	Core Processing: Solids Removal	304
6-2.1	Introduction	304
6-2.2	Chemistry of insoluble fission and corrosion products	304
6-2.3	Experimental study of hydroclone performance	306
6-2.4	HRE-2 chemical processing plant	309
6-3.	Fission Product Gas Disposal	312
6-3.1	Introduction	312
6-3.2	Experimental study of adsorption of fission product gases	313
6-3.3	Design of a fission product gas adsorber system	316
6-3.4	HRE-2 fission product gas adsorber system	316
6-4.	Core Processing: Solubles	317
6-4.1	Introduction	317
6-4.2	Solvent extraction	318
6-4.3	Uranyl peroxide precipitation	318
6-5.	Core Processing: Iodine	319
6-5.1	Introduction	319
6-5.2	The chemistry of iodine in aqueous solutions	320
6-5.3	Removal of iodine from aqueous homogeneous reactors	323
6-6.	Uranyl Sulfate Blanket Processing	326
6-6.1	Introduction	326
6-6.2	Plutonium chemistry in uranyl sulfate solution	326
6-6.3	Neptunium chemistry in uranyl sulfate solution	327
6-6.4	Plutonium behavior under simulated reactor conditions	328
6-6.5	Alternate process methods	330
6-7.	Thorium Oxide Blanket Processing	332
6-7.1	Introduction	332
6-7.2	Thorex process	332
6-7.3	Alternate processing method	335
CHAPTER 7.	DESIGN AND CONSTRUCTION OF EXPERIMENTAL HOMOGENEOUS REACTORS	340
7-1.	Introduction	340
7-1.1	Need for reactor construction experience	340
7-1.2	Sequence of experimental reactors	341

7-2.	Water Boilers	341
7-2.1	Description of the LOPO, HYPO, and SUPO	341
7-2.2	Kinetic experiments in water boilers	345
7-2.3	The North Carolina State College research reactor	346
7-2.4	Atomics International solution-type research reactors	347
7-3.	The Homogeneous Reactor Experiment (HRE-1).	348
7-3.1	Introduction	348
7-3.2	The reactor fuel system	349
7-3.3	The reflector system.	350
7-3.4	The fuel off-gas system	352
7-3.5	Fuel concentration control	353
7-3.6	Power removal	354
7-3.7	Internal-recombination experiments	355
7-3.8	Nuclear safety	355
7-3.9	Leak prevention	356
7-3.10	Shielding	357
7-3.11	Construction cost	357
7-3.12	Maintenance	357
7-3.13	Dismantling the HRE-1	358
7-3.14	Critique of HRE-1	358
7-3.15	Summary of results	359
7-4.	The Homogeneous Reactor Test (HRE-2).	359
7-4.1	Objectives	359
7-4.2	Reactor specifications and description	359
7-4.3	Schedule of construction	369
7-4.4	Nonnuclear testing and operation	371
7-4.5	Nuclear operation	375
7-4.6	Operational techniques and special procedures	376
7-4.7	The HRE-2 mockup	380
7-4.8	The HRE-2 instrument and control system	381
7-4.9	Remote maintenance	387
7-4.10	Containment methods	391
7-4.11	Summary of HRE-2 design and construction experience	395
7-4.12	HRE-2 construction costs	397
7-5.	The Los Alamos Power Reactor Experiments (LAPRE-1 and 2)	397
7-5.1	Introduction	397
7-5.2	Description of LAPRE-1	400
7-5.3	Operation of LAPRE-1	403
7-5.4	Description of LAPRE-2	404
CHAPTER 8.	COMPONENT DEVELOPMENT	408
8-1.	Introduction	408
8-2.	Primary-System Components	409
8-2.1	Core and blanket vessel designs	409
8-2.2	Circulating pumps	413
8-2.3	Steam generators	419
8-2.4	Pressurizers	423
8-2.5	Piping and welded joints	428

8-2.6	Flange closures	429
8-2.7	Gas separators	432
8-3.	Supporting-System Components	434
8-3.1	Storage tanks	434
8-3.2	Entrainment separator	436
8-3.3	Recombiners	436
8-3.4	Condenser	439
8-3.5	Cold traps	439
8-3.6	Charcoal adsorbers	440
8-3.7	Feed pumps	441
8-3.8	Valves	445
8-3.9	Sampling equipment	448
8-3.10	Letdown heat exchanger	450
8-3.11	Freeze plugs	451
8-4.	Auxiliary Components	452
8-4.1	Refrigeration system	452
8-4.2	Oxygen injection equipment	452
8-5.	Instrument Components	454
8-5.1	Signal transmission systems	454
8-5.2	Primary variable sensing elements	455
8-5.3	Nuclear instrumentation in the HRE-2	459
8-5.4	Electrical wiring and accessories	460
CHAPTER 9.	LARGE-SCALE HOMOGENEOUS REACTOR STUDIES	466
9-1.	Introduction	466
9-1.1	The status of large-scale technology	466
9-1.2	Summary of design studies	467
9-2.	General Plant Layout and Design	468
9-2.1	Relation of plant layout to remote-maintenance methods	468
9-2.2	Importance of specifications	469
9-2.3	Approach to an optimum piping system	469
9-2.4	Shielding problems in a large-scale plant	470
9-2.5	Containment	471
9-2.6	Steam power cycles for homogeneous reactors	471
9-3.	One-Region U^{235} Burner Reactors	473
9-3.1	Foster-Wheeler Wolverine Design Study	473
9-3.2	Aqueous Homogeneous Research Reactor-feasibility study	479
9-3.3	The Advanced Engineering Test Reactor	486
9-4.	One-Region Breeders and Converters	487
9-4.1	The Pennsylvania Advanced Reactor U^{233} -thorium oxide reference design	487
9-4.2	Large-scale aqueous plutonium-power reactors	493
9-4.3	Oak Ridge National Laboratory one-region power reactor studies	495
9-5.	Two-Region Breeders	496
9-5.1	Nuclear Power Group aqueous homogeneous reactor	496

9-5.2	Single-fluid two-region aqueous homogeneous reactor power plant	499
9-5.3	Oak Ridge National Laboratory two-region reactor studies	504
CHAPTER 10.	HOMOGENEOUS REACTOR COST STUDIES	514
10-1.	Introduction	514
10-1.1	Relation between cost studies and reactor design factors	514
10-1.2	Parametric cost studies at ORNL	515
10-2.	Bases for Cost Calculations	516
10-2.1	Fuel costs	516
10-2.2	Investment, operating, and maintenance costs	521
10-3.	Effect of Design Variables on the Fuel Costs in $\text{ThO}_2\text{-UO}_3\text{-D}_2\text{O}$ Systems	521
10-3.1	Introduction	521
10-3.2	Two-region spherical reactors	523
10-3.3	One-region spherical reactors	527
10-3.4	Cylindrical reactors	529
10-4.	Effect of Design Variables on Fuel Costs in Uranium-Plutonium Systems	530
10-4.1	One-region $\text{PuO}_2\text{-UO}_3\text{-D}_2\text{O}$ power reactors	530
10-4.2	One-region $\text{UO}_2\text{SO}_4\text{-Li}_2\text{SO}_4\text{-D}_2\text{O}$ power reactors	532
10-4.3	Two-region $\text{UO}_3\text{-PuO}_2\text{-D}_2\text{O}$ power reactors	535
10-5.	Fuel Costs in Dual-Purpose Plutonium Power Reactors	537
10-5.1	One-region reactors	538
10-5.2	Two-region reactors	539
10-6.	Fuel Costs in U^{235} Burner Reactors	539
10-7.	Summary of Homogeneous Reactor Fuel-Cost Calculations	542
10-7.1	Equilibrium operating conditions	542
10-7.2	Nonsteady-state operating conditions	542
10-8.	Capital Costs for Large-Scale Plants	545
10-9.	Operating and Maintenance Costs in Large-Scale Plants	549
10-10.	Summary of Estimated Power Costs	552
	Bibliography, Part I	557

PART II. MOLTEN-SALT REACTORS

CHAPTER 11.	INTRODUCTION	567
CHAPTER 12.	CHEMICAL ASPECTS OF MOLTON-FLUORIDE-SALT REACTOR FUELS	569
12-1.	Choice of Base or Solvent Salts	569
12-2.	Fuel and Blanket Solutions	577
12-2.1	Choice of uranium fluoride	577
12-2.2	Combination of UF_4 with base salts	578

12-2.3	Systems containing thorium fluoride	580
12-2.4	Systems containing Th_4 and UF_4	580
12-2.5	Systems containing PuF_3	581
12-3.	Physical and Thermal Properties of Fluoride Mixtures	581
12-4.	Production and Purification of Fluoride Mixtures	584
12-4.1	Purification equipment	584
12-4.2	Purification processing	585
12-5.	Radiation Stability of Fluoride Mixtures	586
12-6.	Behavior of Fission Products	588
12-6.1	Fission products of well-defined valence	589
12-6.2	Fission products of uncertain valence	590
12-6.3	Oxidizing nature of the fission process	591
12-7.	Fuel Reprocessing	591
CHAPTER 13.	CONSTRUCTION MATERIALS FOR MOLTEN-SALT REACTORS	595
13-1.	Survey of Suitable Materials	595
13-2.	Corrosion of Nickel-Base Alloys by Molten Salts	598
13-2.1	Apparatus used for corrosion tests	598
13-2.2	Mechanism of corrosion	598
13-3.	Fabrication of INOR-8	604
13-3.1	Casting	604
13-3.2	Hot forging	604
13-3.3	Cold-forming	604
13-3.4	Welding	605
13-3.5	Brazing	608
13-3.6	Nondestructive testing	610
13-4.	Mechanical and Thermal Properties of INOR-8	611
13-4.1	Elasticity	611
13-4.2	Plasticity	611
13-4.3	Aging characteristics	616
13-4.4	Thermal conductivity and coefficient of linear thermal expansion	618
13-5.	Oxidation Resistance	619
13-6.	Fabrication of a Duplex Tubing Heat Exchanger	620
13-7.	Availability of INOR-8	623
13-8.	Compatibility of Graphite with Molten Salts and Nickel-Base Alloys	623
13-9.	Materials for Valve Seats and Bearing Surfaces	625
13-10.	Summary of Material Problems	625
CHAPTER 14.	NUCLEAR ASPECTS OF MOLTEN-SALT REACTORS	626
14-1.	Homogeneous Reactors Fueled with U^{235}	628
14-1.1	Initial states	628
14-1.2	Intermediate states	644

14-2.	Homogeneous Reactors Fueled with U^{233}	646
14-2.1	Initial states	650
14-2.2	Intermediate states	650
14-3.	Homogeneous Reactors Fueled with Plutonium	656
14-3.1	Initial states	656
14-3.2	Intermediate states	656
14-4.	Heterogeneous Graphite-Moderated Reactors	657
14-4.1	Initial states	659
CHAPTER 15.	EQUIPMENT FOR MOLTEN-SALT REACTOR HEAT-TRANSFER SYSTEMS	661
15-1.	Pumps for Molten Salts	662
15-1.1	Improvements desired for power reactor fuel pump	664
15-1.2	A proposed fuel pump	665
15-2.	Heat Exchangers, Expansion Tanks, and Drain Tanks	667
15-3.	Valves	667
15-4.	System Heating	668
15-5.	Joints	669
15-6.	Instruments	671
15-6.1	Flow measurements	671
15-6.2	Pressure measurements	672
15-6.3	Temperature measurements	672
15-6.4	Liquid-level measurements	672
15-6.5	Nuclear sensors	672
CHAPTER 16.	AIRCRAFT REACTOR EXPERIMENT	673
CHAPTER 17.	CONCEPTUAL DESIGN OF A POWER REACTOR	681
17-1.	Fuel and Blanket Systems	681
17-1.1	Reactor vessel	681
17-1.2	Fuel pump	682
17-1.3	System for removal of fission-product gases	682
17-2.	Heat-Transfer Circuits and Turbine Generator	687
17-3.	Remote Maintenance Provisions.	688
17-4.	Molten-Salt Transfer Equipment	691
17-5.	Fuel Drain Tank	693
17-6.	Chemical Reprocessing Method	693
17-7.	Cost Estimates	694
Bibliography,	Part II	697

PART III. LIQUID-METAL FUEL REACTORS

CHAPTER 18.	LIQUID-METAL FUEL REACTORS.	703
18-1.	Background	703
18-1.1	Work at Brookhaven National Laboratory	703
18-1.2	Work of study groups	704

18-2.	General Characteristics of Liquid Metal Fuel Reactors	704
18-2.1	Comparison of fluid- and solid-fuel reactors	704
18-2.2	Advantages and disadvantages of LMFR	705
18-3.	Liquid Metal Fuel Reactor Types	706
18-4.	LMFR Program	708
CHAPTER 19.	REACTOR PHYSICS FOR LIQUID METAL REACTOR DESIGN	711
19-1.	LMFR Parameters	711
19-1.1	Cross sections	711
19-1.2	Neutron age and diffusion length	713
19-1.3	Reactivity effects	713
19-1.4	Breeding	714
19-2.	LMFR Statics	715
19-2.1	Core	715
19-2.2	Reflector	715
19-2.3	Critical mass	717
19-2.4	Breeding	717
19-2.5	Control	718
19-2.6	Shielding	719
19-3.	LMFR Kinetics	719
CHAPTER 20.	COMPOSITION AND PROPERTIES OF LIQUID-METAL FUELS	722
20-1.	Core Fuel Composition	722
20-2.	Solubilities in Bismuth	723
20-2.1	Uranium	723
20-2.2	Thorium and plutonium	725
20-2.3	Fission-product solubility	725
20-2.4	Magnesium and zirconium	725
20-2.5	Solubility of corrosion products in bismuth	726
20-2.6	Solubilities of combination of elements in bismuth	726
20-2.7	Salts	730
20-3.	Physical Properties of Solutions	731
20-3.1	Bismuth properties	731
20-3.2	Solution properties	731
20-3.3	Gas solubilities in bismuth	731
20-4.	Fuel Preparation	731
20-5.	Fuel Stability	731
20-5.1	Losses of uranium from bismuth by reaction with con- tainer materials	732
20-5.2	Reaction of fuel solution with air	732
20-6.	Thorium Bismuthide Blanket Slurry	734
20-6.1	Status of development	734
20-6.2	Chemical composition of thorium bismuthide	734
20-6.3	Crystal chemistry of thorium bismuthide	734
20-6.4	Thorium-bismuth slurry preparation	736
20-6.5	Engineering studies of slurries	738

20-7.	Thorium Compound Slurries	741
20-7.1	Thorium oxide	741
20-7.2	Other thorium compounds	741
CHAPTER 21.	MATERIALS OF CONSTRUCTION—METALLURGY	743
21-1.	LMFR Materials	743
21-1.1	Metals	743
21-1.2	Graphite	744
21-2.	Steels	744
21-2.1	Static tests	744
21-2.2	Corrosion testing on steels	751
21-2.3	Thermal convection loop tests at BNL	751
21-2.4	High-velocity tests	759
21-2.5	Rapid oxidation of 2½% Cr-1% Mo steel	767
21-2.6	Radiation effects on steels	768
21-3.	Nonferrous Metals	770
21-3.1	Beryllium	770
21-3.2	Tantalum	770
21-3.3	Molybdenum	771
21-4.	Bearing Materials	771
21-5.	Salt Corrosion	773
21-6.	Graphite	774
21-6.1	Mechanical properties	774
21-6.2	Graphite-to-metal seals	775
21-6.3	Graphite reactions	775
21-6.4	Radiation effects on graphite	779
21-6.5	Bismuth permeation and diffusion into graphite	782
CHAPTER 22.	CHEMICAL PROCESSING	791
22-1.	Introduction	791
22-2.	Volatile Fission Product Removal	795
22-2.1	Xenon and iodine removal	795
22-2.2	Xenon and iodine adsorption on graphite and steel	796
22-2.3	Design of equipment for FPV removal	800
22-3.	Fused Chloride Salt Process	801
22-3.1	Equilibrium distribution	802
22-3.2	Pilot plant equilibrium experiments	809
22-3.3	Reaction rates	811
22-3.4	FPS removal process	812
22-3.5	Process control of fused chloride process	817
22-3.6	Processing to reduce radiation hazard	820
22-3.7	Pilot plant program for fused chloride process	820
22-3.8	Heat generation by fission products	820
22-4.	Fluoride Volatility Process for Fission Products	821
22-5.	Noble Fission Product Removal	823
22-5.1	Characteristics of FPN poisoning	823

22-5.2	Chemistry of NFPN removal by zinc drossing	824
22-5.3	FPN removal for the fused chloride process	825
22-5.4	FPN removal process for the fluoride volatility process	827
22-6.	Blanket Chemical Processing	828
22-7.	Economics of Chemical Processing	829
CHAPTER 23.	ENGINEERING DESIGN	832
23-1.	Reactor Design	832
23-1.1	Externally cooled LMFR	832
23-1.2	Internally cooled LMFR	832
23-1.3	Compact arrangements	833
23-1.4	Open arrangements	834
23-1.5	Containment and safety requirements	834
23-1.6	Design methods	835
23-1.7	Maintenance and repair provisions	836
23-2.	Heat Transfer	836
23-2.1	Nuclear aspects of coolants	837
23-2.2	Pumping-power requirements	840
23-2.3	Heat transfer for LMFR	841
23-2.4	Heat-exchanger design	843
23-3.	Component Design	843
23-3.1	Pumps	843
23-3.2	Valves	848
23-3.3	Piping	849
23-3.4	Heating equipment	852
23-3.5	Insulation	852
23-3.6	System preparation	852
23-3.7	Operation and handling	855
23-3.8	Instrumentation	858
CHAPTER 24.	LIQUID METAL FUEL REACTOR DESIGN STUDY	866
24-1.	Comparison of Two-Fluid and Single-Fluid LMFR Designs	866
24-2.	Two-Fluid Reactor Design	866
24-2.1	General description	866
24-2.2	General specifications	867
24-2.3	End blanket effects	869
24-2.4	Power level in the blanket	870
24-2.5	Selection of a reference design	883
24-3.	Systems Design	888
24-3.1	General	888
24-3.2	Plant arrangement	889
24-3.3	Primary system	891
24-3.4	Intermediate system	892
24-3.5	Reactor heating and cooling system	893
24-3.6	Dump tank heating and cooling	894
24-3.7	Startup heating system	894
24-3.8	Primary inert gas system	895

24-3.9	Intermediate inert gas system	895
24-3.10	Shield cooling	895
24-3.11	Reactor cell cooling	895
24-3.12	Capsule and reactor room cooling	896
24-3.13	Raw water system	896
24-3.14	Instrumentation and control	896
24-3.15	Maintenance	897
24-3.16	Chemical processing	897
24-3.17	Turbine generator plant	898
24-3.18	Off-gas system	899
24-4.	Single-Fluid Reactor Design	900
24-4.1	General description	900
24-4.2	General specifications	900
24-4.3	Parametric study	901
24-4.4	Economic optimization	906
24-4.5	Selection of a reference design	911
24-5.	Economics	920
24-5.1	Fixed charges on capital investment	920
24-5.2	Maintenance and operation	920
24-5.3	Fuel costs	921
24-5.4	Summary of energy costs	921
CHAPTER 25.	ADDITIONAL LIQUID METAL REACTORS	930
25-1.	Liquid Metal Fuel Gas-Cooled Reactor	930
25-1.1	Introduction and objectives of concept	930
25-1.2	Reference design characteristics of an LMF-GCR	931
25-1.3	Fuel and fuel system	935
25-1.4	Reactor materials	938
25-1.5	Plant operation and maintenance	938
25-1.6	Plant capital and power cost	939
25-2.	Molten Plutonium Fuel Reactor	939
25-2.1	Introduction	939
25-2.2	Basic components	940
25-2.3	LAMPRE	942
25-3.	Liquid Metal-Uranium Oxide Slurry Reactor	944
Index		947