

CONTENTS

	Page
Chapter 1 Thorium: History, Sources and Uses	1
Chapter 2 Properties of Thorium	12
I General Characteristics	12
II Physical Properties	13
III Mechanical Properties	22
IV Thorium Compounds	27
V Alloys	40
Chapter 3 Thorium-Bearing Ores: Their Deposits and Methods of Concentration	50
I Characteristics of Thorium-bearing ores	50
II Major Thorium-Bearing Minerals	51
III Methods of concentration Thorium Ores	58
Chapter 4 Extraction of Thorium From Ores	62
I Introduction	62
II Sulfuric and Extraction Process	64
III Caustic soda Extraction Process	85
IV Cost Comparison – sulfuric acid vs. Caustic soda Digestion	97
V Miscellaneous Extraction Processes	97
Chapter 5 Purification of Thorium Concentrates	102
I Introduction	102
II Solvent extraction	137
III Other methods of purifying thorium precipitate	139
IV Separation of Uranium from thorium by ion exchange	139
Chapter 6 Preparation of Thorium Metal by Reduction	146
I Preparation of a Reducible Thorium Salt	146
II Reduction to thorium metal	168
Chapter 7 Melting and Casting of Thorium	202
I Induction-Melting of Thorium metal	202
II Arc-melting of Thorium metal	211
Chapter 8 Fabrication of Thorium	222
I General Characteristics	222
II Heat treatment and recrystallization	222
III Preparation of rods from ingots	229
IV Further fabrication	232
V Slug inspection	236
VI Thorium powder metallurgy	236
Chapter 9 Health and Safety Aspects of Thorium Production	242
I Health hazards of thorium	242
II Health hazards of the production process	248
III Fire and Explosion hazards of thorium production	252
Chapter 10 Testing Procedures	255
I Wet chemical analytical methods	255
II Experimental solvent-extraction program	261
III Spectrographic methods	262
IV Metallography	264