

CONTENTS

PREFACE

SOFTWARE AVAILABILITY

CONTENTS

1. INTRODUCTION	1
Deformation Processes during Creep	3
Deformation Mechanism Maps	9
Fracture and Fracture Maps	15
Alloy Strengthening Processes	22
Materials for High Temperature Service	27
2. UNIAXIAL CREEP TESTING	37
Tensile Creep Testing	38
Creep Testing in Compression	45
Constant Stress Creep Equipment	52
Causes of Scatter in Creep Testing	56
The Influence of Material Variables on Data Scatter	63
3. PRIMARY AND SECONDARY CREEP BEHAVIOUR	69
Primary and Secondary Creep Curve Fitting	70
Representation of Creep Data for Pure Metals	77
Microstructural Observations during Creep of Pure Metals	85
Creep Behaviour of Single-Phase Alloys	93
Creep Behaviour of Particle-Hardened Alloys	104
4. DISLOCATION CREEP PROCESSES	114
Dislocation Creep Mechanisms at Low and High Temperatures	115
Stress-Change Experiments during Power-Law Creep	122
Stress-Change Behaviour during Creep of Aluminium	135
A Phenomenological Interpretation of Stress-Change Behaviour	144
A Microstructural Model for Creep	149

5. TERTIARY CREEP AND FRACTURE	
Cavity Formation during Creep	157
Theories of Cavity Development	167
Damage Accumulation in Creep-Resistant Alloys	175
Rejuvenation	184
Representation of Tertiary Creep and Rupture Data	189
6. THE θ PROJECTION CONCEPT	197
Creep and Fracture of $\frac{1}{2}\text{Cr}\frac{1}{2}\text{Mo}\frac{1}{4}\text{V}$ Ferritic Steel	202
Interpolation and Extrapolation of Data	209
Primary and Tertiary Creep Processes	217
Rationalization of Creep Data	228
Constitutive Equations	237
REFERENCES	244
APPENDIX A - Finite Element Analysis for Creeping Structures	257
APPENDIX B - Constant Stress Level Calculations	266
APPENDIX C - Creep Curve Parameter Estimation	274
APPENDIX D - Grain Boundary Phenomena in Polycrystals	295
INDEX	308