Contents

Contributors	vii
Preface.	ix

A Unified Treatment of Evolving Interfaces Accounting for Small Deformations and Atomic Transport with Emphasis on Grain-Boundaries and Epitaxy

Eliot Fried and Morton E. Gurtin

I.	Introduction	5
	DEFORMATION AND ATOMIC TRANSPORT IN BULK	13
II.	Mechanics	13
III.	Balance Law for Atoms	14
IV.	Thermodynamics. The Free-Energy Imbalance	15
V.	Substitutional Alloys	17
VI.	Global Theorems	22
VII.	Constitutive Theory for Multiple Atomic Species in the	
	Absence of a Lattice Constraint	25
VIII.	Digression: The Gibbs Relation and Gibbs-Duhem Equation	
	at Zero Stress	34
IX.	Constitutive Theory for a Substitutional Alloy	36
Х.	Governing Equations	50
	CONFIGURATIONAL FORCES IN BULK	52
XI.	Configurational Forces, Power	52
XII.	Thermodynamical Laws for Migrating Control Volumes.	
	The Eshelby Relation	56
XIII.	Role and Influence of Constitutive Equations	62
	INTERFACE KINEMATICS	64
XIV.	Definitions and Basic Results	64
XV.	Deformation of the Interface	70
XVI.	Interfacial Pillboxes	73
	GRAIN BOUNDARIES	74
XVII.	Simple Theory Neglecting Deformation and Atomic Transport	74

v

Contents

XVIII.	Interfacial Couples. Allowance for an Energetic Dependence on	(
XIX.	Grain–Vapor Interfaces with Atomic Transport	(
	STRAINED SOLID-VAPOR INTERFACES. EPITAXY	1(
XX.	Configurational and Standard Forces	1
XXI.	Power	1
XXII.	Atomic Transport	1
XXIII.	Free-Energy Imbalance	1
XXIV.	Normal Configurational Force Balance Revisited	1
XXV.	Constitutive Equations for the Interface	1
XXVI.	Governing Equations at the Interface	1
XXVII.	Interfacial Couples. Allowance for an Energetic Dependence	
	on Curvature	1
XXVIII.	Allowance for Evaporation–Condensation	1
	COHERENT PHASE INTERFACES	1
XXIX.	Forces. Power	1
XXX.	Atomic Transport	1
XXXI.	Free-energy Imbalance	1
XXXII.	Global Theorems	1
XXXIII.	Normal Configurational Force Balance Revisited	1
XXXIV.	Constitutive Equations for the Interface	1
XXXV.	General Equations for the Interface	1
	Acknowledgments	1
	Appendix A: Justification of the Free-Energy Conditions (9.40)	
	at Zero Stress. Gibbs Relation	1
	Appendix B: Equivalent Formulations of the Basic Laws.	
	Control-Volume Equivalency Theorem	1
	Appendix C: Status of the Theory as an Approximation of the	
	Finite-Deformation Theory	1
	References	1

Instability of Multi-Layer Channel and Film Flows

C. Pozrikidis

I.	Introduction	179
II.	Channel Flow	181
III.	Film Flow	207
IV.	Discussion	228
	Acknowledgments	229
	Appendix A: Surfactant Transport	229
	References	235

Author Index	241
Subject Index	245

vi