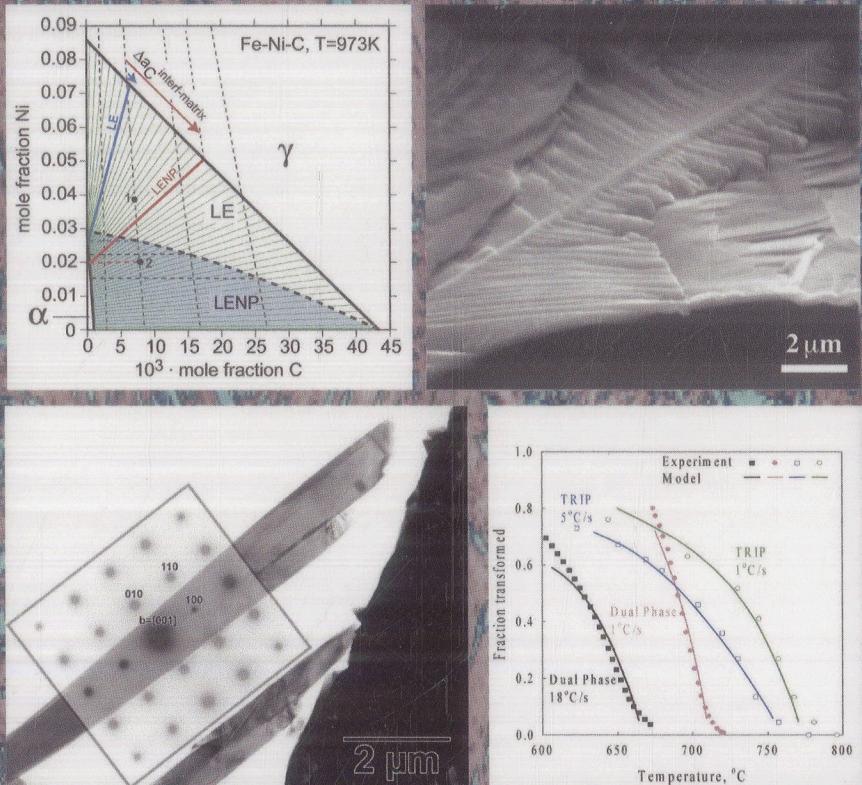


A Symposium on the Thermodynamics,  
Kinetics, Characterization and Modeling of

# Austenite Formation and Decomposition



Edited by  
**E. Buddy Damm and Matthew J. Merwin**

# TABLE OF CONTENTS

|   |      |
|---|------|
| Preface.....                                | ix   |
| Acknowledgements/Organizing Committee ..... | xi   |
| Peer Review Committee.....                  | xiii |

## Thermodynamics and Kinetics

|   |     |
|---|-----|
| The Bay Phenomenon in Steels with Reasonably Strong Carbide Formers.....  | 3   |
| <i>M. Hillert and L Höglund</i>   |     |
| The Role of Carbon on the Kinetics of Bainite Transformation in Steels .....  | 15  |
| <i>D. Quidort, O. Bouaziz and Y. Bréchet</i>  |     |
| The Influence of Alloy Element Partitioning on the Shapes of TTT Start Curves in Steels.....  | 27  |
| <i>R.E. Hackenberg and G.J. Shiflet</i>   |     |
| Effects of High Magnetic Field on Phase Transformation Behavior and Structure in Fe-Based Alloys .....                                  | 43  |
| <i>H. Otsuka, X. Hao and H. Wada</i>  |     |
| The Diffusional Formation of Allotriomorphic Ferrite from Austenite in Fe-C-X Systems. The Simplest Case: Fe-C-Ni.....                  | 49  |
| <i>C.R. Hutchinson, A. Fuchsmann, H. Zurob and Y. Bréchet</i>   |     |
| Interfacial Conditions at the Moving Interface During Growth of Ferrite from Austenite in Fe-C-(X) Alloys .....                         | 65  |
| <i>G. Inden and C.R. Hutchinson</i>   |     |
| Competition Between Allotriomorphic and Idiomorphic Ferrite Transformations Kinetics.....   | 81  |
| <i>C. Capdevila, F.G. Caballero and C. García de Andrés</i>   |     |
| Influencing of Alloying Element Accumulation at $\alpha/\gamma$ Boundaries on the Growth of Proeutectoid Ferrite in Fe-C-Mn Alloys..... | 97  |
| <i>M. Enomoto</i>   |     |
| Computer Prediction of Para-Equilibrium Transformations.....  | 113 |
| <i>B. Sundman</i>   |     |

|  |     |
|--|-----|
| Investigation of the Interaction Between Recovery and Precipitation in a Model Austenitic Alloy: Experimental and Modelling Results .....      | 121 |
| H.S. Zurob, C.R. Hutchinson, G.R. Purdy<br>and Y. Brechet  |     |
| A Study of the Transition Kinetics from Para-Equilibrium to Ortho-Equilibrium .....  | 139 |
| J.M. Vitek, S.S. Babu and E. Kozeschnik  |     |
| Non-Equilibrium Reaction Paths in Ferrous Austenite Decomposition .....  | 149 |
| R.E. Hackenberg and G.J. Shiflet   |     |
| Deviation from Local-Equilibrium During Austenite to Ferrite Transformation.....   | 167 |
| J. Ågren   |     |
| Characterization of Low Temperature Ferrite/Austenite Transformations in the Heat Affected Zone of 2205 Duplex Stainless Steel Arc Welds ..... | 177 |
| T.A. Palmer, J.W. Elmer, S.S. Babu and J.M. Vitek  |     |
| <br><b>Modeling and Characterization</b>   |     |
| Challenges in Modeling the Overall Austenite Decomposition Kinetics .....  | 195 |
| M. Militzer  |     |
| Influence of Thermomechanical Treatment on the Austenite-Pearlite Transformation in a High Carbon Nb-Microalloyed Steel .....                  | 213 |
| E. Cotrina, B. López and J.M. Rodríguez-Ibáñez   |     |
| Modelling the Effects of Microalloying on the Hardenability of High Strength Steels .....  | 227 |
| T. Siwecki and B. Rodell   |     |
| In-Situ Characterization of Austenite to Martensite Decomposition in 9Cr-1Mo-V Steel Welds.....  | 247 |
| M.L. Santella, S.S. Babu, R.W. Swindeman<br>and E.D. Specht  |     |
| Prediction of Phase Transformation Kinetics and Microstructures in Low-Carbon High Strength Steels.....  | 257 |
| T. Iung, M. Kandel, S. Lacroix, A. Perlade<br>and D. Quidort   |     |
| Austenite Decomposition:<br>Modelling and Measuring at the Level of Individual Grains .....  | 267 |
| S. van der Zwaag, J. Sietsma, E. Offerman<br>and N. van Dijk   |     |

|  |     |
|--|-----|
| Simulation of Proeutectoid Ferrite Precipitation During Technical Heat Treatment .....   | 279 |
| <i>G. Pariser, P. Shaffnit, I. Steinbach and W. Bleck</i>  |     |
| Microstructure Characterization of the Austenite Decomposition of HSLA Steel Strip.....  | 291 |
| <i>J. Wu, P.J. Wray, M. Hua, C.I. Garcia<br/>and A.J. DeArdo</i>   |     |
| On the Role of Kinematics in Constructing Predictive Models of Austenite Decomposition.....  | 311 |
| <i>M.T. Lusk, W. Wang, X. Sun and Y.-K. Lee</i>  |     |
| Two Problems in Ledgewise Growth of Ferrite Requiring Further Advanced Experimental Techniques for Their Solution.....                                       | 333 |
| <i>W.T. Reynolds, Jr., H.I. Aaronson and H. Goldstein</i>  |     |
| Characterization and Prediction of Austenite Formation and Decomposition in Steel Welds.....   | 343 |
| <i>S.S. Babu, J.M. Vitek, S.A. David, T. Palmer<br/>and J.W. Elmer</i>   |     |
| Analysis of the $\gamma \rightarrow \alpha$ Transformation in a C-Mn Steel by Dilatometry, Laser Scanning Confocal Microscopy and Phase Field Modelling..... | 353 |
| <i>M.G. Mecozzi, J. Sietsma, S. van der Zwaag,<br/>M. Apel, P. Shaffnit and I. Steinbach</i>   |     |
| Influence of Deformation on Austenite to Ferrite Transformation in Low Carbon Steels: Experimental Approach and Modelling.....                               | 367 |
| <i>S. Lacroix, Y. Bréchet, M. Véron, D. Quidort,<br/>M. Kandel and T. Iung</i>   |     |
| Peritectic Reaction in the Iron-Carbon, Iron-Nickel, and Iron-Chromium-Nickel Systems.....   | 381 |
| <i>N.J. McDonald and S. Sridhar</i>  |     |
| <br><b>Austenite and Cementite</b>   |     |
| The Divorced Eutectoid Transformation and Spheroidization of Steels .....  | 397 |
| <i>G.M. Michal and M.D. Novak</i>  |     |
| The Proeutectoid Cementite Transformation .....  | 415 |
| <i>G. Spanos and M.V. Kral</i>   |     |
| The Interfacial Structure of Widmanstätten Cementite Laths.....  | 425 |
| <i>R.W. Fonda, M.V. Kral and W.T. Reynolds, Jr.</i>  |     |
| Precipitate Coarsening and Grain Growth in Steels.....   | 437 |
| <i>K.C. Russell</i>  |     |

|   |     |
|---|-----|
| Contribution to the Study of Austenite Formation in Steels .....  | 457 |
| <i>F.G. Caballero, C. Capdevila, D. San Martín<br/>and C. García De Andrés</i>  |     |
| Modeling the Formation of Austenite from Ferrite-Carbide Aggregates.....  | 475 |
| <i>M. Hunkel, H. Surm, Th. Lübben, O. Kessler,<br/>F. Hoffman and P. Mayr</i>   |     |
| <br><b>Fundamentals of Multiphase Steels</b>  |     |
| Transformation Toughening in Dispersed-Phase Systems.....   | 493 |
| <i>G.B. Olson and C.J. Kuehmann</i>   |     |
| Quenching and Partitioning: A Fundamentally New Process to Create<br>High Strength Trip Sheet Microstructures .....                               | 505 |
| <i>J.G. Speer, A.M. Streicher, D.K. Matlock, F. Rizzo<br/>and G. Krauss</i>   |     |
| On the Austenite Retention in Low Alloy Steels .....  | 523 |
| <i>S. Godet, C. Georges and P.J. Jacques</i>  |     |
| Quasi-Adiabatic Effects During the High Strain Rate Deformation of<br>Dispersed-Phase Systems with Strain-Induced Martensitic Transformation..... | 537 |
| <i>B.C. De Cooman, L. Samek, J. Mahieu,<br/>J. Van Slycken, P. Verleysen, J. Degrieck, L. Lin,<br/>L. Wang, X.C. Wei and S. Peng</i>              |     |
| Phase Transformation Behavior During Continuous Cooling and<br>Isothermal Holding of Aluminum and Silicon Bearing Trip Steels.....                | 549 |
| <i>N. Fonstein, N. Potiore, S.H. Lalam<br/>and D. Bhattacharya</i>  |     |
| Effect of Annealing Temperature on Austenite Decomposition in a<br>Si-Alloyed Trip Steel .....  | 563 |
| <i>M.F. Gallagher, J.G. Speer and D.K. Matlock</i>  |     |
| The Influence of Nb on the Phase Transformations and Mechanical<br>Properties in Al- and Si- Alloyed Trip-Steels .....                            | 577 |
| <i>S. Traint, A. Pichler, K. Spiradek-Hahn, K. Hulká<br/>and E. Werner</i>  |     |
| Author Index .....  | 595 |
| Subject Index .....   | 597 |