Preface

The National Institute for Materials Science (NIMS) of Japan has long been working on research and development projects related to advanced steels, and now the development of environmentally friendly steel products has become an urgent necessity. The main idea in the production-process project is to utilize technologies for refined and ultra-refined steels. Mechanical properties of ultra-grain refined steels are almost equivalent to those of conventional high-strength and high-toughness steels produced with rare and expensive alloying elements. In this book, advanced steels developed at NIMS, based primarily on unique structural controlling process techniques, their mechanical properties, and their property improvement mechanisms are presented and discussed. The following is an overview of each chapter.

Chapter 1 Introduction: Environmental Problems and Related Advanced Steel Techniques (T. Hanamura)

Tensile strength and toughness of advanced steels are discussed from both the fundamental and engineering points of view.

Chapter 2 Ultra-Fine-Grained Steel: Relationship Between Grain Size and Tensile Properties (T. Hanamura)

Some phenomena in tensile properties unique to ultra-fine grained steels are presented and discussed. These phenomena include an increase in the strain-hardening rate with increasing carbon content up to 0.3 wt. % C and a strain-hardening rate almost constant even with a further increase in carbon content.

Chapter 3 Ultra-Fine-Grained Steel: Relationship Between Grain Size and Impact Properties (T. Hanamura)

Impact properties unique to ultra-fine grained steels are discussed. These properties include excellent fracture toughness owing to the steel’s characteristic small effective grain size and high surface energy of fracture in comparison with those of other steel structures.
Chapter 4 Ultra-Fine-Grained Steel: Fracture Toughness (Crack-Tip-Opening Displacement) (H. Qiu)

The variation tendency of fracture toughness with ferrite grain size is discussed in detail, and the fracture toughness of ultra-fine grained steel is evaluated.

Chapter 5 Summary (T. Hanamura)

The main focus of the book is summarized, namely the tensile strength and toughness of advanced steels from both the fundamental and engineering points of view.
Analysis of Fracture Toughness Mechanism in Ultra-fine-grained Steels
The Effect of the Treatment Developed in NIMS
Hanamura, T.; Qiu, H.
2014, X, 64 p. 47 illus., Softcover
ISBN: 978-4-431-54498-2