Preface

Steel is used in many industries because of its favorable attributes and low cost relative to other materials. It is a globally dominant material and is a key driver of the world's economy. The auto industry is one of the biggest markets for steel products. In an era of weight reduction, steel was not perceived as a lightweight or a high-tech material because of its high density. This perception has changed with the introduction of new grades of high-specific-strength steels. The steel industry continues to develop new steel grades and innovative design concepts to meet challenges related to vehicle performance, affordability, safety, fuel efficiency, and the environment.

One key driver for steel development is the continuing increase in Corporate Average Fuel Economy (CAFE) standards from the current 27.5 mpg to 34.1 mpg by 2016 and to 54.5 mpg by 2025. A number of advanced high-strength steels (AHSS) that are highly formable and possess an excellent combination of strength, ductility, and strain hardening have been produced or are under development. Advanced high-strength steels are not lighter than traditional steels, but their high strength permits the use of thinner gages to reduce vehicle weight. The new steels extend the tensile strength limit of 800 MPa (116 ksi) provided by traditional high-strength steels (HSS) to over 1600 MPa (232 ksi). The superior properties of AHSS result from microstructural design that utilizes complex deformation and/or phase transformation processes.

The auto industry has adopted lightweighting as a greenhouse gas reduction strategy and automakers are now employing more AHSS in their vehicles to maintain affordability, reduce weight, lower emissions, and improve crash safety. Currently, AHSS account for 80 kg (175 lb) per vehicle and this is projected to double by 2020. Advanced high-strength steel panels and structures are becoming thinner, lighter, tougher, and stronger than those made from mild steel and traditional HSS. Studies have indicated that the economic and performance targets of automakers cannot be met without the significant use of steel. Advanced high-strength steels are

currently the fastest growing class of materials offering solutions for current and future vehicles. It is believed that steel will continue to be the dominant material for the automotive market.

This book is a comprehensive guide to the grades, types, microstructures, thermal processing, deformation mechanisms, properties, performance, and applications of AHSS. The first objective of the book is to understand the drivers and solutions for building lighter, safer, efficient, and affordable cars. The second objective is to develop a rationale for using AHSS to accomplish weight reduction, fuel economy, crash safety, cost savings, and decrease in greenhouse gases. The third objective is to examine the complex interrelationship between composition, processing, microstructure, and mechanical properties. The fourth objective is to review the design guidelines, manufacturing hurdles, advanced forming, sustainability, and evolving grades of AHSS. The book is an essential reference/text for those who teach, study, develop, produce, use, design, or specify AHSS. A compelling and unique feature of the book is the extensive use of charts, figures, tables, and micrographs to provide a good perspective of the structure-property relationships and performance attributes of AHSS.