Preface to the Second Edition

Hydrogen embrittlement is an interdisciplinary problem covering materials science, mechanics, and electrochemistry, and its manifestation is diverse according to materials, environments, and loading methods. Studies of hydrogen embrittlement have a long history. The intention of the first edition, in 2016, was primarily to share fundamental and comprehensive knowledge, including retrospective works, for smooth discussion on hydrogen embrittlement of steel.

Disputes about the function of hydrogen in embrittlement have not yet been settled. However, establishing reliable principles for materials design and assessing their performance are recent urgent industrial needs in developing high-strength steel for hydrogen energy equipment and weight-reducing vehicles. Fortunately, progress in the past decade in experimental and theoretical tools is remarkable and has nearly unveiled characteristic features of hydrogen embrittlement. Proposed models have almost covered feasible aspects of the function of hydrogen.

In this second edition, the contents are enriched with recent crucial findings, chapters are reorganized, and the description is revised for readers' convenience to provide a more systematic and unified view of hydrogen embrittlement. A new chapter is created for delayed fracture in long-time atmospheric exposure as a conclusive subject of critical ideas on the mechanism of hydrogen embrittlement presented in this book. Understanding the function of hydrogen in a general scheme of fracture events is this book's latent but vital intention.

Following the first edition, previous studies are critically reviewed, and supplemental descriptions of fundamental ideas are presented when necessary. Emphases are placed on experimental facts, with particular attention to their implication rather than phenomenological appearance. The adopted experimental conditions are also noted since the operating mechanism of hydrogen might differ by material and environment. For theories, employed assumptions and premises are noted to examine their versatility.

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