PREFACE

This is the second volume of an advanced text book set on the microstructure and properties of materials. The first volume is on aluminum alloys, Nickel-base superalloys, metal matrix composites, polymer matrix composites, ceramics matrix composites, inorganic glasses, superconducting materials and magnetic materials. This volume covers titanium alloys, titanium aluminides, Iron aluminides, iron and steels, iron-base bulk amorphous alloys and nanocrystalline materials.

More specifically Chapter 1 on titanium alloys covers the production, thermomechanical processing, microstructure, mechanical properties and applications. Chapter 2 on titanium aluminides discusses phase stability, bulk and defect properties, deformation mechanisms of single phase materials and polysynthetically twinned crystals and interfacial structures and energies between phases of different compositions. Chapter 3 on Iron Aluminides reviews the physical and mechanical metallurgy of Fe_3Al and FeAl, the two important structural intermetallics. Chapter 4 on iron and steels presents methodology, microstructure at various levels, strength, ductility and strengthening, toughness and toughening, environmental cracking and design against fracture for many different kinds of steels.

Chapter 5 on bulk amorphous alloys shows the critical cooling rate and the effect of composition on glass formation and the accompanying mechanical and magnetic properties of the glasses. Chapter 6 on nanocrystalline materials describes the preparation from vapor, liquid, and solid states, microstructure including grain boundaries and their junctions, stability with respect to grain growth, particulate consolidation while maintaining the nanoscale microstructure, physical, chemical, mechanical, electric, magnetic and optical properties and applications in cutting tools, superplasticity, coatings, transformers, magnetic recordings, catalysis and hydrogen storage.

Material problems are important for almost all industries. New materials are needed daily. But the principles and the relationships between properties and microstructure remain similar. The more we know about these relations the easier will be to find new materials with desired properties. If you would like to see certain material included in the third volume, please email me at li@me.rochester.edu.

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October, 1999