

Chapter 1

Introduction

This book was written for several reasons. First, boriding has always been the object of interest due to the fact that it allows to obtain the unique combination of mechanical, corrosion and tribology properties of surface layers in ferrous alloys. Boriding as a method of surface hardening attracts specialists from different industry areas. The only restriction which prevents its wide spread is the insufficient plasticity of boronized layers. It impedes boriding from being used for hardening details that work under conditions of alternating loads and risks of mechanical and thermal shocks.

The critical attitude towards the plasticity of boronized metals and alloys began to appear in the earliest works in this area. The attempts to enhance the plasticity by specific alloying and using thermal methods have been made many times. Quite frequently they gave good results.

This book is dedicated to the study of boriding in the context of enhancing the plasticity of boronized layers. For the last dozen of years specialists have been given a chance to obtain layers with enhanced plasticity by using concentrated energy sources. For instance, the pivotal change in the layer structure and hence the changes in its plasticity can be achieved by the radiation-thermal impact of electron streams under boriding or by treating the preliminary obtained traditional boronized layers.

Boriding combined with concentrated energy sources changes the structure of layers, the morphology of obtained phases, the character and spread of bonds formed in the near-surface area. Moreover it turns out that the intensity of these changes can be effectively controlled by introducing different modes, for instance, the mode of radiation-thermal impact. It led to a fundamental possibility of creating a composite boronized layer with a heterogenic dispersed morphology and a Chinese-script eutectic structure of boride crystals instead of a columnar (needle or

tooth-like) morphology. The constructing of different composition levels which combine “solid” and “soft” phases in different ways allowed to obtain boronized layers with different ductility on steel surfaces.

The most recent Russian-language book on boriding was published quite a long time ago—about 25 years ago. It was L.G. Voroshnin and L.S. Lyakhovich’s study which can be translated as “Steel Boriding” [1]. It successfully combined scientific and technological data on boriding processes which is still relevant.

The authors of the book presented to you don’t mean to repeat already recognized facts. This study is an attempt to add some new information. To give the reader more thorough knowledge on the development of boriding, the book contains the analysis of double and triple B-Fe and B-C-Fe systems, components’ properties and basic phases: solid boron solution in iron and iron borides. Moreover it shows the evolution of binary and triple phase equilibrium diagrams in time, beginning with the first built diagram; two complete double B-Fe diagrams created in different periods and the authors’ variant of the full diagram are given. The work also deals with the method of building equilibrium diagrams with four and more components and the use of such diagrams in the process of boriding.

The authors hope that this book would be useful not only for specialists working in the fields of chemical and thermal treatment but for graduate- and postgraduate students, engineers and scientists in machine building, metallurgy, mining, textile and other industries.

When the book was almost finished, one of the authors, a prominent scientist and a brilliant teacher, a famous metal industry worker—Boris Alekseevich Prusakov—passed away. Boris Alekseevich initiated the work on this book and wanted it to be useful for everyone who was interested in the problem of metals and alloys hardening. We hope that he was (as always) right. Unfortunately, for the last time...

Reference

1. *Voroshnin L.G., Lyakhovich L.S. Borirovanie stali. Moscow, 1978. 239 p. [Voroshin L.G., Lyakhnovich L.S. Steel Boriding]*

<http://www.springer.com/978-3-319-40011-2>

Plasticity of Boronized Layers

Krukovich, M.G.; Prusakov, B.; Sizov, I.

2016, XI, 364 p. 113 illus., 12 illus. in color., Hardcover

ISBN: 978-3-319-40011-2