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Phase Diagrams, Crystallographic and Thermodynamic Data

critically evaluated by MSIT®

Subvolume A
Light Metal Systems

Part 2
Selected Systems from Al-Cu-Fe to Al-Fe-Ti

Editor
G. Effenberg

Authors
Materials Science and International Team, MSIT®

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The present series of books results from collaborative evaluation programs authored by MSIT® in which data and knowledge are contributed by many individuals and accumulated over almost twenty years. Authors for the evaluations in this volume are:

Ibrahim Ansara†, Grenoble, France
Laura Arrighi, Genova, Italy
Peter Budberg, Moscow, Russia
Gabriele Cacciamani, Genova, Italy
Yong Du, Changsha, China
Günter Effenberg, Stuttgart, Germany
Riccardo Ferro, Genova, Italy
Gautam Ghosh, Evanston, USA
Bernd Grieb, Tübingen, Germany
Grushko, Jülich, Germany
Mireille G. Harmelin, Paris, France
Michael Hoch, Cincinnati, USA
Jan van Humbeeck, Leuven, Belgium
Hermann A. Jehn, Stuttgart, Germany
Kiyohito Ishida, Sendai, Japan
K.C. Hari Kumar, Chennai, India
Nathalie Lebrun, Lille, France
Xing Jun Liu, Sendai, Japan
Hans Leo Lukas, Stuttgart, Germany
Rinaldo Marazza, Genova, Italy
Pierre Perrot, Lille, France
Alexander Pisch, Grenoble, France
Alan Prince†, Harpenden, UK
Qingsheng Ran, Stuttgart, Germany
Paola Riani, Genova, Italy
Nigel Saunders, Guildford, UK
Eberhard E. Schmid, Frankfurt, Germany
Rainer Schmid-Fetzer, Clausthal-Zellerfeld, Germany
Ludmila Tretyachenko, Kyiv, Ukraine
Cui Ping Wang, Sendai, Japan
Patric Wollants, Leuven, Belgium
Gilda Zanicchi, Genova, Italy
Liming Zhang, München, Germany

Institutions

The content of this volume is produced by Materials Science International Services GmbH and its international team of materials scientists, MSIT®. Contributions to this volume have ben made from the following institutions:

Central South University, Research Institute of Powder Metallurgy, State Key Laboratory for Powder Metallurgy, Changsha, China

ENSEEG, Laboratoire de Thermodynamique et Physico-Chimie Metallurgiques, Domaine Universitaire Saint Martin d'Heres, Cedex, France

Forschungszentrum Jülich, Institut für Festkörperforschung (IFF), Institut Mikrostrukturforschung, Jülich, Germany

I.M. Frantsevich Institute for Problems of Materials Science, National Academy of Sciences, Kyiv, Ukraine

Indian Institute of Technology Madras, Department of Metallurgical Engineering, Chennai, India

Katholieke Universiteit Leuven, Department Metaalkunde en Toegepaste Materiaalkunde, Heverlee, Belgium

Magnequench Europe, Tübingen, Germany

Materials Science International Services GmbH, Stuttgart, Germany

Max-Planck-Institut für Metallforschung, Institut für Werkstoffwissenschaft, Pulvermetallurgisches Laboratorium, Stuttgart, Germany

Northwestern University, Department of Materials Science and Engineering, Evanston, USA

Technische Universität Clausthal, Metallurgisches Zentrum, Clausthal-Zellerfeld, Germany

Tohoku University, Department of Materials, Science Graduate School of Engineering, Sendai, Japan

Universita di Genova, Dipartimento di Chimica, Genova, Italy

Universite de Lille I, Laboratoire de Métallurgie Physique, Villeneuve d'ASCQ, Cedex, France

Universität München, Institut für Kristallographie und Angewandte Mineralogie, München, Germany

University of Cincinnati, Department of Materials Science and Engineering, Cincinnati, USA

University of Surrey, Department of Materials Science and Engineering, Guildford/Surrey, UK

Preface

The sub-series *Ternary Alloy Systems* of the *Landolt-Börnstein New Series* provides reliable and comprehensive descriptions of the materials constitution, based on critical intellectual evaluations of all data available at the time. The first four volumes contain evaluation reports on selected ternary systems of importance to industrial light alloy development and systems which gained in the recent years otherwise scientific interest in the area of light metal systems. In a ternary materials system, however, one may find alloys for various applications, not only light alloys, depending on the chosen composition.

Reliable phase diagrams provide scientists and engineers with basic information of eminent importance for fundamental research and for the development and optimization of materials. So collections of such diagrams are extremely useful, if the data on which they are based have been subjected to critical evaluation, like in these volumes. Critical evaluation means: there where contradictory information is published data and conclusions are being analyzed, broken down to the firm facts and re-interpreted in the light of all present knowledge. Depending on the information available this can be a very difficult task to achieve. Critical evaluations establish descriptions of reliably known phase configurations and related data.

The evaluations are performed by MSIT®, Materials Science International Team, a group which works together since almost 20 years, now. Within this team skilled expertise is available for a broad range of methods, materials and applications. This joint competence is employed in the critical evaluation of the often conflicting literature data. Particularly helpful in this are targeted thermodynamic calculations for individual equilibria, driving forces or complete phase diagram sections.

Insight in materials constitution and phase reactions is gained from many distinctly different types of experiments, calculation and observations. Intellectual evaluations which interpret all data simultaneously reveal the chemistry of a materials system best. The conclusions on the phase equilibria may be drawn from direct observations e.g. by microscope, from monitoring caloric or thermal effects or measuring properties such as electric resistivity, electro-magnetic or mechanical properties. Other examples of useful methods in materials chemistry are mass-spectrometry, thermo-gravimetry, measurement of electro-motive forces, X-ray and microprobe analyses. In each published case the applicability of the chosen method has to be validated, the way of actually performing the experiment or computer modeling has to be validated and the interpretation of the results with regard to the material's chemistry has to be verified.

An additional degree of complexity is introduced by the material itself, as the state of the material under test depends heavily on its history, in particular on the way of homogenization, thermal and mechanical treatments. All this is taken into account in an MSIT expert evaluation.

To include binary data in the ternary evaluation is mandatory. Each of the three-dimensional ternary phase diagrams has edge binary systems as boundary planes; their data have to match the ternary data smoothly. At the same time each of the edge binary systems A-B is a boundary plane for many ternary A-B-X systems. Therefore combining systematically binary and ternary evaluations can lead to a new level of confidence and reliability in both ternary and binary phase diagrams. This has started systematically for the first time here, by the MSIT® Evaluation Programs applied to the *Landolt-Börnstein New Series*.

The multitude of correlated or inter-dependant data requires special care. Within MSIT® an evaluation routine has been established that proceeds knowledge driven and applies both, human based expertise and electronically formatted data and software tools. MSIT® internal discussions take place in almost all evaluations and on many different specific questions, adding the competence of a team to the work of individual authors. In some cases the authors of earlier published work contributed to the knowledge base by making their original data records available for re-interpretation. All evaluation reports published here have undergone a thorough review process in which the reviewers had access to all the original data.

In publishing we have adopted a standard format that presents the reader with the data for each ternary system in a concise and consistent manner. Special features of the compendium and the standard format are explained in the Introduction to the volumes.

In spite of the skill and labor that have been put into this volume, it will not be faultless. All criticisms and suggestions that can help us to improve our work are very welcome. Please contact us via effenberg@msiwp.com. We hope that this volume will prove to be an as useful tool for the materials scientist and engineer as the other volumes of *Landolt-Börnstein New Series* and the previous works of MSIT® have been. We hope that the *Landolt Börnstein Sub-series, Ternary Alloy Systems* will be well received by our colleagues in research and industry.

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Contents

IV/11A2 Ternary Alloy Systems
Phase Diagrams, Crystallographic and Thermodynamic Data

Subvolume A Light Metal Systems

Part 2 Selected Systems from Al-Cu-Fe to Al-Fe-Ti

Introduction

Data Covered XI
General XI
Structure of a System Report XI
- Literature Data XI
- Binary Systems XI
- Solid Phases XII
- Pseudobinary Systems XIII
- Invariant Equilibria XIII
- Liquidus, Solidus, Solvus Surfaces XIII
- Isothermal Sections XIII
- Temperature – Composition Sections XIII
- Thermodynamics XIII
- Notes on Materials Properties and Applications XIII
- Miscellaneous XIII
- References XVI

General References XVII

Ternary Systems

Al–Cu–Fe (Aluminium – Copper – Iron) 1
Al–Cu–Gd (Aluminium – Copper – Gadolinium) 38
Al–Cu–Mg (Aluminium – Copper – Magnesium) 47
Al–Cu–Mn (Aluminium – Copper – Manganese) 79
Al–Cu–Nb (Aluminium – Copper – Niobium) 98
Al–Cu–Ni (Aluminium – Copper – Nickel) 104
Al–Cu–Sc (Aluminium – Copper – Scandium) 127
Al–Cu–Si (Aluminium – Copper – Silicon) 135
Al–Cu–Tb (Aluminium – Copper – Terbium) 148
Al–Cu–Ti (Aluminium – Copper – Titanium) 156
Al–Cu–Yb (Aluminium – Copper – Ytterbium) 174
Al–Cu–Zn (Aluminium – Copper – Zinc) 182
Al–Cu–Zr (Aluminium – Copper – Zirconium) 206
Al–Dy–Fe (Aluminum – Dysprosium – Iron) 223
Al–Dy–Ni (Aluminium – Dysprosium – Nickel) 233
Al–Er–Fe (Aluminium – Erbium – Iron) 242
Al–Er–Ni (Aluminium – Erbium – Nickel) 249

Al–Fe–Gd (Aluminium – Iron – Gadolinium) 257
Al–Fe–Ho (Aluminium – Iron – Holmium) 268
Al–Fe–La (Aluminium – Iron – Lanthanum) 276
Al–Fe–Mg (Aluminium – Iron – Magnesium) 285
Al–Fe–Mn (Aluminium – Iron – Manganese) 292
Al–Fe–N (Aluminium – Iron – Nitrogen). 309
Al–Fe–Nd (Aluminium – Iron – Neodymium). 316
Al–Fe–Ni (Aluminium – Iron – Nickel) 329
Al–Fe–Si (Aluminium – Iron – Silicon) 359
Al–Fe–Sm (Aluminium – Iron – Samarium) 410
Al–Fe–Tb (Aluminium – Iron – Terbium) 418
Al–Fe–Ti (Aluminium – Iron – Titanium) 426

CD-ROM providing interactive access to the system reports of this volume