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Quenching and Control of Distortion

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Conference Proceedings

Edited by

Johann Grosch

Jörg Kleff

Thomas Lübben

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**Conference Organization:**

Arbeitsgemeinschaft Wärmebehandlung und Werkstofftechnik e.V.
AWT
Sonja Müller
Paul-Feller-Str. 1
28199 Bremen
Germany
E-Mail: awt.ev@t-online.de

Preface

Heat treatment aims at establishing within a component a microstructure that is able to withstand any loading conditions that arise from the function of the component. Each microstructure having a specific volume, it follows that heat treatment inevitably causes distortion, which must not be necessarily homogeneous in anisotropic initial microstructures. On heating, residual stresses existing in a component are being reduced, most often by deformation, sometimes by cracks. Distortion after heat treatment is thus dependent on all pre-heat-treatment production steps from which follows that distortion can be controlled by optimizing the production steps.

Microstructures far from equilibrium have always the highest strength. Therefore an important step in the process of establishing the microstructure is always cooling or quenching from heat treatment temperature. Quenching, above all, is of significant influence and allows maintaining oversaturated microstructural conditions which are the starting point for age hardening or quenching and tempering. The quenching characteristics, dependent on quenchant and quenching technique, together with the material determine the extent to which also with complex part shapes those quenched microstructures are attained that are necessary for the demanded properties. Each change in microstructure – desired aim of every heat treatment – leads to a change in volume. Rapid temperature changes generate temperature gradients in the component; these can lead to thermal stresses and, dependent on the material, to transformation stresses, too. Volume changes and thermal and transformation stresses determine distortion and plastic strains, caused by the heat treatment. The quenching characteristic is a crucial factor for the control of microstructure and distortion that is globally at the focus of extensive research activities.

The term Distortion Engineering today encompasses all the measures taken to control distortion, reaching from the production of the material, the optimization of the production steps and the heat treatment to the tailor-made use of distortion potentials.

The conference sequence „Quenching and Control of Distortion“ was initiated in 1993 by George Totten, the proceedings of the previous conferences show impressively the current state and continual further development of knowledge in this area. The 5th Conference Quenching and Control of Distortion once again offers engineers and scientists from universities and industry the opportunity to gain insight into the rapidly advancing knowledge in this field, it offers a forum for lectures and discussions. The present proceedings are intended to help that lectures and discussions may stay alive in the memory of each conference participant.

Johann Grosch, Berlin

Jörg Kleff, Friedrichshafen

Thomas Lübben, Bremen

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¹*Utsunomiya University, Tohigi, Japan*

²*Komatsu, Japan* ³*Nissan Motor, Yokohama, Japan*

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Scott MacKenzie¹, Zhichao Li², B. Lynn Ferguson²

¹*Houghton International Inc., Valley Forge, USA*

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Hans Berns¹, Haroldo Pinto²

¹*Ruhr-University Bochum, Bochum, Germany*

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F. Frerichs¹, Th. Lübben¹, F. Hoffmann¹, H.-W. Zoch¹, M. Wolff²

¹*Institut für Werkstofftechnik, Bremen, Germany*

²*Zentrum für Technomathematik, Universität Bremen, Germany*

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¹*Arimotech Ltd, Osaka, Japan*, ²*Maruemu Works, Osaka, Japan*, ³*IMST, Nagoya, Japan*,

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¹*University of Bremen, FB 4/08, Bremen, Germany,*

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¹*Stiftung Institut für Werkstofftechnik, Badgasteiner Str. 3, 28359 Bremen, Germany*

²*Universität Rostock, Lehrstuhl Werkstofftechnik, Rostock, Germany*

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