wbk
Institut für Produktionstechnik

Einfluss des Fügespalts auf die erreichbare Verbindungsqualität beim Sinterfügen

Zur Erlangung des akademischen Grades

Doktor der Ingenieurwissenschaften

der Fakultät für Maschinenbau

Karlsruher Institut für Technologie (KIT)

genehmigte

Dissertation

von

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aus Karlsruhe

Tag der mündlichen Prüfung:	29. Januar 2014
Hauptreferent:	Prof. Dr.-Ing. Jürgen Fleischer
Korreferent:	Prof. Dr. rer. nat. Oliver Kraft

KIT
Karlsruher Institut für Technologie

Bibliografische Information der Deutschen Nationalbibliothek
Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über http://dnb.d-nb.de abrufbar.

Zugl.: Karlsruhe, Karlsruher Institut für Technologie, Diss., 2014

Printed in Germany.

ISBN 978-3-8440-2628-3
ISSN 0724-4967

Shaker Verlag GmbH • Postfach 101818 • 52018 Aachen
Telefon: 02407 / 95 96 - 0 • Telefax: 02407 / 95 96 - 9
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Abstract

The increasing integration of functions into technical systems does not only require a miniaturizing of the individual components but also suitable ways within the production process to integrate individual parts into the overall system. Thereby, it is unavoidable to use joining processes. The MIM (metal injection moulding) sinter joining that was examined as part of this work represents an innovative joining method for connecting MIM components at reduced effort. With this method, MIM green parts are assembled directly after the moulding and are joined in the anyway necessary sintering process.

A demand for research was derived from the state of the art and state of research that was systematically examined in this work regarding the requirements of the initial surface contact for producing high-quality joints. The studies were exemplarily carried out on rotationally symmetric samples of hollow parts made of carbonyl iron.

Objectives of the work are the identification of the relevant mechanisms during MIM sinter joining, the development of an adequate shape of the joining surfaces for rotationally symmetric hollow joining partners as well as the investigation of the relationships between the deviations in shape of the joining surfaces and the resulting quality of the joint.

At first, a sinter joining model is developed according to the objectives, on which the determination of the most important effects influencing the joining procedure is based.

After identifying conical joining surfaces as a suitable surface shape, the influence of the initial joining gap width on the joint quality before joining is systematically examined with this shape. By means of micrograph investigations and CT scans as well as tensile tests for the sinter joints, precision requirements for a high quality of the joint can be identified. The joint quality is evaluated on the basis of the following criteria: completeness of the sinter joint, shape accuracy of the samples in the joint area and the adjacent area and tensile strength.

The identified precision requirements are stored in a toleration tool for hollow rotationally symmetric joining partners of carbonyl iron that serves as a device for an automatic determination of the required tolerances in MIM sinter joining.