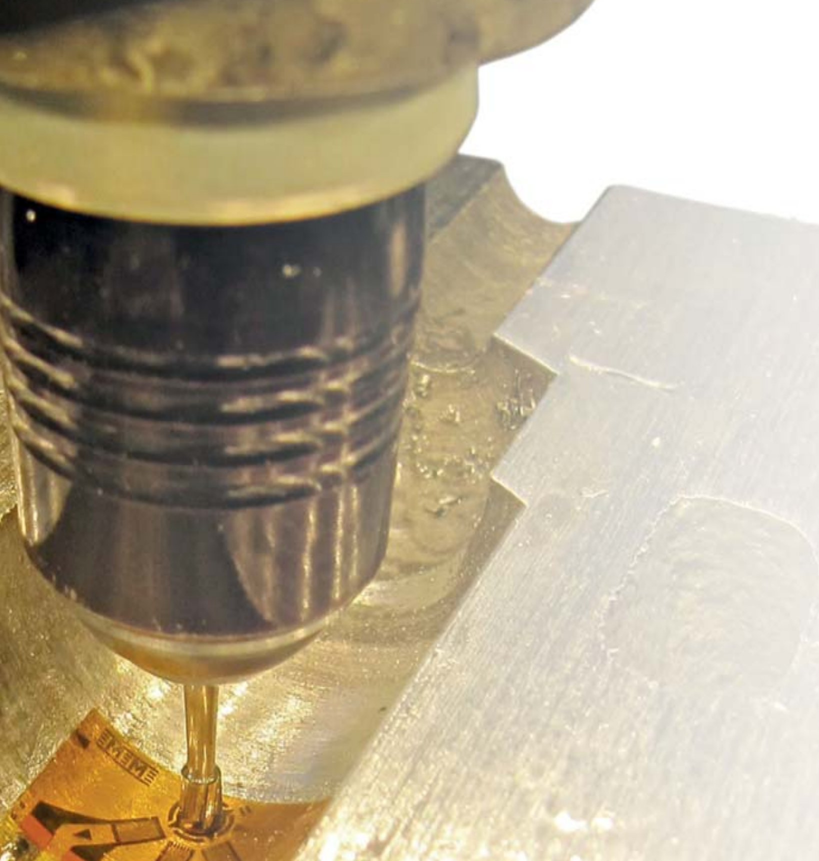


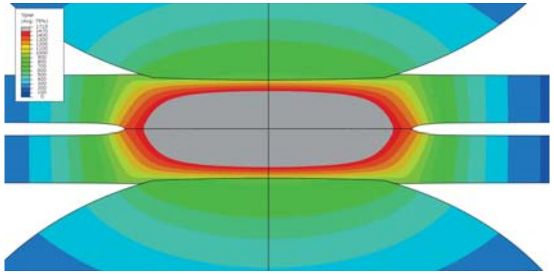
We perform residual stress analyses according to the following methods:

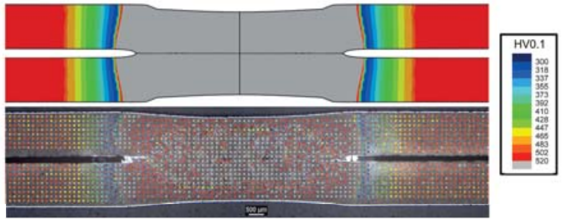
- Hole drilling method
- Ring core method
- Longitudinal slot method (adaptable to many geometries and depths)
- Boring and dressing method
- Layer removal method
- X-ray diffraction method (Siemens Diffraktometer D5000)

Department:
Joining Technology and Additive Manufacturing

https://www.mpa.uni-stuttgart.de/en/institute/departments/joining-technology-and-additive-manufacturing/

Calculated temperature distribution of similar plates made of 22MnB5+AS at the end of the welding time through numerical process simulation





Comparison of a spot-welded joint of numerically (above) and experimentally (below) measured hardness according to Vickers (HV0.1)

Contact
Dr.-Ing. Martin Werz
Phone: +49 711 685 62597
Fax: +49 711 685 63053
E-Mail: martin.werz@mpa.uni-stuttgart.de
Internet: http://www.mpa.uni-stuttgart.de

MPA STUTTGART Materials Testing Institute University of Stuttgart

Department Joining Technology and Additive Manufacturing

Units

- Additive Manufacturing
- Joining Technology
- Stress Analysis and Residual Stress
- Transformations-Hub CyberJoin

University of Stuttgart
Germany

The Joining Technology and Additive Manufacturing department considers joining and welding technology as well as additive manufacturing as a triad of process technology, material condition and the resulting strength properties.

Thus, the influence of the process parameters on the occurring structures, the formation of geometry and ultimately the mechanical properties is being analyzed in experimental testing as well as numerical process simulations. We have a well-equipped welding laboratory at our disposal for experimental testings of issues concerning manufacturing and process engineering. In addition to the experimental testing of process limitations and the identification of stable process parameters for existing joining processes, we develop new processes and process variations particularly for joining of varying materials.

For several welding processes, continuum mechanical simulation models are being developed which can also accounts for complex material behavior like the temperature and strain rate dependent hardening by use of our own material models. Furthermore, the thermal-mechanical-electrical interaction, e.g. with resistance spot welding, can be accounted for by using a specially implemented sequential coupling method.

At joining processes and additive manufacturing, usually high temperature gradients occur which can lead to complex residual stress behavior. The residual stresses superimpose with the operational loads and thus often reduce the fatigue strength of join connections or additively manufactured components.

On the basis of the experimental stress analysis, residual stress at welded joints and large components as well as stresses during operation of a component can be determined.

Application of strain gauges for strain measuring

Functions / Core Business

- Performing sample welds
- Consulting services for joining technology
- On-site support, recreation of process problems in the laboratory and fault analysis
- Measuring of process factors electrical current, voltage, force, displacement, temperature etc.
- Measuring of transition resistance and electrical material resistance
- Measuring of residual stress
- Application of strain gauges and formation of components into force measuring elements
- Optical strain measuring
- Physical simulation of structure formation typical for welding

Additively manufactured samples

Special Installations

- Friction stir welding machines
- Resistance welding machines for spot welding and projection welding
- Ultrasonic welding machines
- Gleeble (machine for thermomechanical, physical structure simulation)
- Several universal testing machines e.g. for tensile, pressure and bend testings

Machine ESAB Legio-3ST, Friction Stir Welding (FSW)