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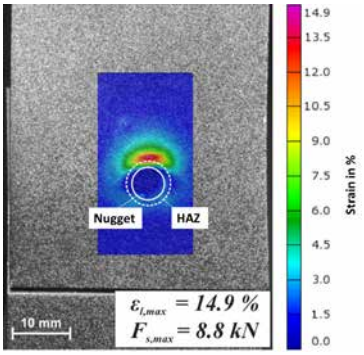

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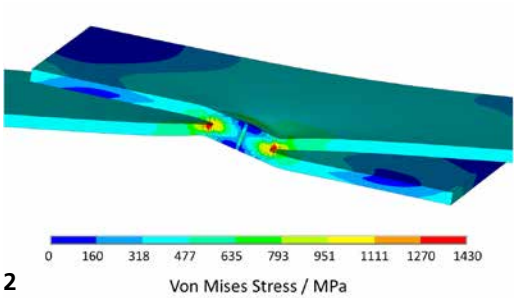

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1 *Expansion behavior of a spot welded steel sheet loaded by tensile stress*

2 *Simulated expansion behavior of a spot welded steel sheet loaded by tensile stress*

RESISTANCE SPOT WELDING

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Resistance spot welding (RSW) is ideal for joining parts made of electrically conductive metal. The technique is a classic joining technology and is mainly used in car body construction where a single body in white can have as many as 6000 spot welds.

In order to respond to the challenges of the intensifying energy crisis and to meet customer requirements for automobiles such as weight reduction for energy saving and enhancement of passenger safety, new materials have to be applied in automobile manufacture.

The challenge of composite materials

The resistance spot welding capability of materials and combinations of materials is a critical cost factor in the construction of lightweight body in white. We investigate the influence of joining parameters on process reliability in resistance spot welding of high tensile steels. We also test the yield strength of spot welded components made of high tensile steel materials, such as multiphase micro-structured AHSS – Advanced High Strength Steels. Resistance spot welding is an economic and reliable joining technique that leads to cost savings and conservation of resources whilst maintaining or even improving safety in the passenger compartment (crash performance optimization). Results are implemented in collaboration with industry and national and international standardization bodies.

Welding gun for resistance spot welding

Our expertise

Research work on resistance spot welding at Fraunhofer IPK is mainly focused on effects of imperfections on the load-bearing behavior of resistance spot welded materials. Another focus is the weldability of innovative automobile materials.

Testing methods have been developed at Fraunhofer IPK that enable comparison of susceptibility to cracking in different materials with the aim of gaining a new understanding of how cracks are formed, how they develop and what happens in the failure stage. State-of-the-art systems for measuring the temperature field and degree of distortion enable analysis of results. The qualitative effects of the resultant stress ratios at the welding spots are determined in simulations.

Our services

Our service range begins with consultancy and feasibility studies and covers all subsequent stages through to implementation of the technique in the existing manufacturing chain. Working in close collaboration with the customer, we ground project goals on a solid scientific foundation and drive development all the way to operability. We offer our customers a broad needs-oriented spectrum of services – from parameter-optimized process development to procedural components testing – which map both the static and cyclic loads and the crash loads of the material.

The following points of investigation are of particular interest:

Yield strength of spot welds
- Tensile strength under different stress loads
- Cross-tensile strength under different stress loads

Fracture analysis of spot welded joints
- Test type dependent fracture analysis for torsion, tensile-sheer, peel, chisel and cross-tension testing
- Analysis of fracture type and fracture surface
- Fracture mechanics of spot welds

Hardness of spot welded joints
- Application of a variety of hardness test procedures
- Hardness distribution in the spot weld and the heat-affected zone

Fatigue behavior of spot welded joints
- Vibration strength of spot welded joints and spot welded structures
- Fatigue crack growth
- Fatigue fracture analysis

Your benefits

Our research and development services aim to assure the cost-effective use of the resistance spot welding technique. Insight into the processability of critical materials that gives an understanding of the effects of weld imperfections on load-bearing behavior offers a qualitative advantage on today's competitive markets when it comes to reliability in the processing of modern types of steel. A clearly defined reliable procedure allows us to calculate the processability of your proposed materials or module geometry in terms of the impact of imperfections in the joining zone. The close bonds between basic research and applied research at Fraunhofer IPK assure you the very best solutions for your individual applications.