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Characterisation of solidification processes during transient liquid phase bonding with rapidly solidified brazing ribbons from the melt spinning process

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Abstract. In technical joining processes, such as brazing, locally molten phases are generated in the workpiece, forming a metallurgical bond between filler metal and base material. Heat input, melting and solidification processes can thereby lead to shrinkage, mismatch and warpage. Furthermore, different process parameters, such as heating rate and holding time, influence the formation of the joining zone and especially the development of the microstructure. Due to the limited possibilities to influence these factors directly and by additional mutual interactions of these factors, the precision and reproducibility of the joints is reduced. As a consequence, rejects arise or post-production steps become necessary to remove defects, such as shrinkage, mismatch and warpage. Therefore, the aim of an interdisciplinary research group at the RWTH Aachen University is to achieve high precision in joined components by controlling and manipulating the factors determining the precision during the joining process. To reach this goal, in a first step the factors that influence precision are analysed.

The Transient Liquid Phase (TLP) bonding is a brazing method based on diffusion of braze metal constituents into the base material and of base metal constituents into the braze metal leading to isothermal solidification. The aim of this study is to analyse the timescale of the solidification and the diffusion processes of the constituents. For this purpose rapidly solidified Sn based braze ribbons from the melt spinning process were brazed at high vacuum with aluminium casting alloy for highly dynamically stressed components for automobile and engineering industry. Prior to the brazing experiments the microstructure of the braze ribbons was analysed by electron microscopy. The melting ranges were examined by differential scanning calorimetry (DSC). The braze seam was analysed by scanning electron microscopy with respect to the phase fractions in dependence of the composition of the ribbons.



Influence of nitrogen on the corrosion resistance of martensitic stainless steels

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Abstract. The corrosion resistance of martensitic stainless steels (MSS) depends strongly on the chemical composition and the applied heat treatment. Both determines the distribution of the alloying elements in the microstructure and the resulting material properties. The addition of nitrogen is known to be beneficial for the pitting corrosion resistance of stainless steels. In case of MSS this effect is not only connected to nitrogen itself because nitrogen can be used to substitute carbon which also influences the result of the heat treatment process. This paper shows the effect of nitrogen on the corrosion resistance in relation to the hardening process of MSS. Therefore the effects of austenitization duration, austenitization temperature and cooling rate on microstructure, hardness and corrosion resistance were studied on the MSS X30CrMoN15 1 and X50CrMoV15. The effect of different cooling rates was studied in the range of > 100 K/s down to 1 K/s using the jominy end quench test. The changes in corrosion resistance were detected with electrochemical potentiodynamic reactivation (EPR) and by the determination of critical pitting potentials. Besides this experimental approach thermodynamic calculations with the software thermocalc will be presented and used for the interpretation of the effect of nitrogen on the corrosion resistance of MSS.