PROCESS MONITORING AND ADAPTIVE CONTROL FOR LASER-HYBRID WELDING

Task

During hybrid welding two processes are combined – laser beam welding and gas metal arc welding. Compared to conventional arc welding procedures, hybrid welding achieves higher feed rates with both lower heat input and distortion simultaneously. The coupling of the procedures requires, however, complex interactions. To join metal sheets using the hybrid process – both automatic and traceable as well as with constant high quality – a multitude of parameters have to be adjusted and recorded. A series of signals and variables have to be measured and recorded online or even controlled by regulators. This project aims to create such a system on the basis of a network architecture open for extensions in the future.

Method

In the framework of the HQ-TUBES project funded by the EU, a demonstrator for hybrid laser-arc welding of tubes and pipes will be set up. Available components for monitoring parameters and controlling process variables will be linked in an Open Diagnostics System (ODS). The ODS system documents relevant parameters, records available signals and allows the systematic allocation of results of post process analysis in retrospect. This approach will enable the systematic analysis of the interaction between parameters, signals and variables, as well as the results of the hybrid process.

Result

The demonstrator consists of a robot cell, a 10 kW disc laser and a MIG/MAG welding unit. The hybrid configuration in the robot hand combines the laser beam and the gas metal arc. A seam tracking system calculates the desired position of the hybrid configuration to the joint in advance. The Coaxial Process Control (CPC) monitors the interaction zone of the process with a high speed camera. A special designed root monitor observes the weld process at the lower side of the butt joint and inspects the solidified root seam. The adjusted parameters as well as the image data recorded by the CPC system and the root monitor are traceable and stored in a data base structure.

Applications

- Automated production of tubes and pipes with longitudinal and spiral seams
- Automated production of 3D structures and segments in shipbuilding

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1 Robot cell with hybrid configuration.
2 Hybrid configuration with coaxial process monitoring.