Electron Beam Welding in steel processing

The Electron Beam Welding process provides a high potential of productivity improvement in steel industry by automation. A temporally and locally adjusted heat management, as needed for Heat Resistant Hardable Chromium Steel Alloys during welding process, however, requires a high process capability. This can be achieved by an operator-independent production metrology, as developed in this project.

Productivity increase by electron beam welding

The electron beam welding method (Electron Beam Welding = EBW), shall be applied in industry to an increasing degree. In the heavy-plate processing steel industry, the application of the EBW method offers the possibility to generate an industrial and fully automatic production from a manually operated process.

Beam measurement and objective measured data interpretation

For the industrial production the proof of process transferability between different welding equipment is required. To this end, the beam characteristics of the EBW equipment in Graz and in Aachen are measured using the beam measuring system diaBEAM, Figure 1.

Fig. 1: diaBEAM measurement set-up in the EBW equipment of the TU Graz
The evaluation of the measuring results is a challenge, on the one hand, caused by the data volume and, on the other hand, by the user-dependent room for interpretation.

For an objective interpretation, an automated measuring data evaluation based on image recognition algorithms is implemented into the software. Figure 2 depicts in the white area, on the right, the beam cross-section which was extracted from the primary mapping photograph from the Figure on the left. The further developed software allows now automatically for the objective, i.e. user-independent interpretation of the gained measuring results in accordance with DIN EN ISO 11146-1.

**Effects**

Industrial acceptance of EBW requires besides the qualification of the material, always the cross-system process capability. This is ensured only by the regular measurement of the tool beam, by the software extension which was developed within the framework of this project. This way, the direct comparison of various beam generators among one another and also the adjustment of the beam generators to the parameters of the reference beam by feedback of the difference values is possible.

The successful process transfer from the EBW equipment in Graz to Aachen has established the industrial applicability of the material / process combination.

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**Contact and information**

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