High-Power Fibre Lasers – Application Potentials for Welding of Steel and Aluminium Sheet Material

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Abstract. Latest developments in laser physics have enabled the production of high-power fibre lasers with beam powers up to 10 kW at excellent beam quality. Adding to these properties their high energetic efficiency, their considerable estimated lifetime and their compact size, they might well be considered to be a viable alternative to both conventional lamp- or diode-pumped Nd:YAG- as well as to CO_2-Lasers. However, due to the novelty of the system, very few experiences on their usability for materials processing and in special for welding of steel and aluminium sheet material are existing. To help this situation, a 7 kW high-power fibre laser system was tested at the Bremer Institut fuer angewandte Strahltechnik, and its potentials for welding steel and aluminium sheets have been assessed. By these results, of which a selection is presented here, it could indeed be demonstrated that it is possible to remarkably enhance process limitations considering welding speed and sheet thickness previously regarded to be inevitable when welding with solid-state lasers. Consequently, in July 2004 the first high-power fibre laser with a beam power exceeding 10 kW at a BPP of less than 12.5 mm*mmrad was tested in cooperation with SLV M-V Rostock. This laser source is currently used for developing mainly welding, but also cutting and cladding applications for a variety of industries. Within these studies, it was e. g. demonstrated that it is possible to achieve a penetration of 10 mm in EN-AW 6082 at a welding speed of 3 m/min.