Innovative laser process for edge finishing of high-strength steel sheets

When cutting sheet metal, manufacturers often find it impossible to prevent burrs and surface defects, such as microcracks, from forming. These surface defects significantly impair the mechanical properties of sheet metal components, e.g. as they can initiate fatigue cracks under dynamic loading. Furthermore, burrs increase the risk of injury to people and impair the functionality of components or machines.

Improvement of edge crack sensitivity and cyclic loading capacity

Laser edge finishing of sheet metal is an innovative new finishing process for deburring, specific edge shape adjustment and smoothing of sheet metal materials. It is based on using continuous laser radiation to remelt the edge of a component. When the metal is in the liquid state, the roughness of the edge can flow out due to surface tension and is smoothed. Burrs and microcracks can also be melted in this way. Through the appropriate choice of process parameters, a defined rounding of the edge up to edge reinforcement can also be set. At the same time, since the material solidifies so quickly, the edge area is thereby heat treated and the microstructure selectively changed.

Significant advantages with laser finished edges

Fraunhofer ILT has demonstrated feed rates of up to 9 m/min with a 5 kW diode laser. Hole expansion tests and Diabolo tests show that the edge crack sensitivity of high-strength steels is significantly reduced and the forming capacity is increased by more than 240 percent compared to the conventionally produced cut edge. Fatigue tests also show that the number of cycles of a laser-finished cut edge can be increased by 220 percent compared with a non-finished cut edge. Laser edge finishing has been demonstrated on an industrial scale using both large components and series parts.

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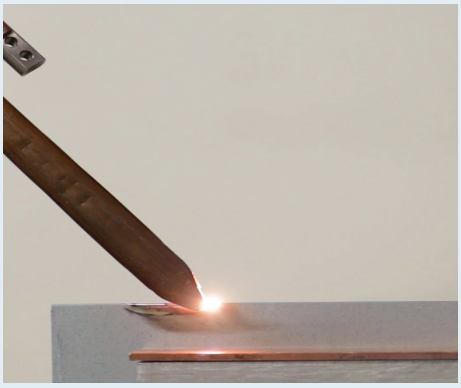

1 Laser edge finishing process.
2 Laser edge finished specimen for hole expansion test.