Fraunhofer IWS Dresden

FRAUNHOFER-INSTITUT FÜR WERKSTOFF- UND STRAHLTECHNIK IWS

REMOTE LASER CUTTING OF METALLIC MATERIALS

remocut®M

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Task

Modern solid state lasers with output powers in the multiple kW range allow cutting speeds of straight cuts that cannot be achieved on real cutting contours. This aspect becomes even more evident with reduced material thicknesses. For example, sheets with a thickness of 0.5 mm can be straight cut at 100 m min^{-1}. However, common cutting machines achieve medium speeds in the range of 20 m min^{-1} when cutting complex structures, such as rotor or stator sheets. The reason for this can be found in the inertia of the cutting heads (high moved masses), which allow only low acceleration speeds.

Solution

A considerable reduction of moving masses can be achieved by remote cutting. »Remote« means »from a distance« and enables working distances of several hundred millimeters. This new type of process doesn't need melt removal by a cutting gas jet. Thus, the use of a cutting head is not longer necessary.

For this reason, the laser beam can be guided highly dynamically across the workpiece using mirror deflection systems, in order to create virtually any desired contour. Thus, time-consuming acceleration and deceleration phases are omitted.

Results

The remote cutting process utilizes the gas pressure of the metal vaporization, to remove the melt from the cutting kerf. In this process, the material is ablated layer-by-layer. Studies have shown that the utilization of this technology allows a considerable increase of the cutting speed on the contour.

When using a 1 kW laser system, materials with thicknesses up to 200 µm can be cut at cutting speeds of up to 400 m min^{-1}. With 5 kW laser output power, complex stainless steel contours with a thickness of 0.5 mm can be cut at speeds up to 80 m min^{-1} (see Fig. 1, 2).

Application examples

Application areas of *remocut®M* are complex contours with a demand on high cutting speeds, short cycle times and reduced heat input. Another advantage is the flexibility of the process in case of rapid tooling.
Applications:

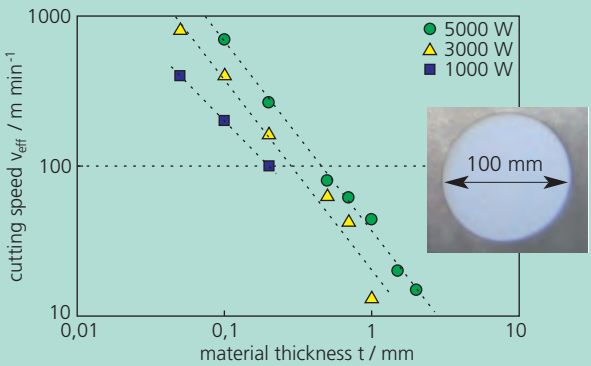
- 2D trimming of metal foils,
- laser cutting of gasket geometries and spring elements,
- remote cutting of geometries for fuel cells,
- production of exposure masks,
- contour cutting of metal-ceramic composites, for example: battery technology,
- selective cutting of layer composites (kiss cutting).

1,2 Sample geometries created by remote cutting

3 Remote laser cutting system

Characteristic data *remocut®M*

Maximum material thickness		
	at 1 kW:	0.2 mm
	at 5 kW:	1.2 mm
Height of burrs for material thicknesses	0.2 mm:	< 10 µm
	1.0 mm:	< 20 µm
Achievable form tolerance and position tolerance:		± 100 µm



Achievable cutting speeds for remote cutting of stainless steel foils