CUTTING SODA-LIME GLASS WITH CO LASER RADIATION

Task

Since the eighties, CO_2 lasers emitting at 10.6 µm have been established industrially as high-performance components for material processing among laser beam sources with wavelengths in the mid-infrared range (3 to 50 µm). Above all they are used for cutting and welding aluminum and steel as well as for processing many non-metallic materials, which usually have a high absorption capacity in the infrared range. Apart from the specific gas mixture, CO lasers have a similar structure to CO_2 lasers, but emit at 5.5 µm in the mid-infrared range. Fraunhofer ILT is examining a CO-based laser process on various non-metallic materials, among others, soda-lime glass.

Method

The CO laser investigated here has been combined with a telescope for beam widening, a focusing lens with a focal length of 127 mm and two xy-linear axes to form a processing unit. The jet path is purged with dry air or nitrogen because the absorption of the water vapor contained in ordinary air distorts or expands the laser beam (thermal blooming). The cutting gas nozzle is fed with N_2 and has a diameter of 2 mm; the distance to the workpiece is 2 mm.

Results

Sections were produced from a 1 mm thick flat sample of soda-lime glass at a speed of 10 mm/s, an average CO laser power of 95 W and 0.8 bar N_2 cutting gas pressure. The cut edges are rough, but the glass sample does not show the shell-like cracks typical of CO_2 cutting.

Applications

As an alternative to CO_2 laser radiation, CO lasers with a wavelength of 5.5 µm can be used to process many non-metallic materials with similar processing results. Conspicuous differences are found when cutting soda-lime glass: While glass absorbs the CO_2 laser radiation only in a very thin, near-surface layer and cracks as a result of the resulting stresses, the CO radiation is coupled over the entire sample thickness because of the greater optical penetration depth so that a largely crack-free kerf arises. Thus, CO lasers could be applied for the cutting of thin glass sheets.

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3 CO laser cut in 1 mm thick soda-lime glass (top view), v = 10 mm/s, P = 95 W, p = 0.8 bar, nitrogen.