SPATIAL BEAM CHARACTERIZATION OF A CU-HBR LASER

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1. Introduction

In laser material processing, the knowledge of laser beam characteristics is as important as the material characteristics. If, for example, the intensity profile of the laser radiation is somewhat deteriorated, the desired perfomance cannot be achieved, even if the total power or energy keeps inaltered.

To the characterization of the laser beam, it is not enough to obtain the spots impressed in thermosensitive paper nor the profile impressed in acrylic blocks, since these techniques provide only qualitative information. It is important to determine with the best accuracy the beam diameter in several positions, the M^2 quality factor or the beam divergence, the stability and the emission profile (spatial and temporal).

Particularly for the Cu-HBr laser, which emits in multimode, this beam characterization is important to know the parameters that affect the processing.

2. Experimental

It was used a laser beam diagnostic equipment constituted by a laser beam sampler (LBS-100, Spiricon, UT, USA), a laser beam analyser (LBA-100, Spiricon, UT, USA) and a CCD camera (EIA, Taiwan). From the experimental data, a non gaussian beam propagation curve was fitted and the M^2 quality factor was calculated. The value of M^2 expresses numerically the beam quality (M^2=1 corresponds to a gaussian beam and M^2>1, to a higher order mode) and, in practical terms, the magnification of the beam width relative to the equivalent gaussian.

As afterwards, in the processing experiments with Cu-HBr laser, the laser power will be controlled by a variable aperture iris placed inside the cavity. This experiment was repeated with different apertures.

3. Results and Discussions

Some discrepancy between experimental and fitted curves was observed, probably due to the combination of two factors: the reduction in beam intensity produced by the iris and the precision in the aperture reprodution.

The M^2 quality factor obtained was 4,9 for totally open iris. The value of M^2 dimishes when the iris aperture decreses, as this iris eliminates the edge modes and favours the lower modes, and consequently resulting in a more gaussian profile.

This experiment allowed the determination of laser beam propagation after a focusing lens, the M^2 quality factor and the beam width and position in the beam waist.

4. References

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