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Chemical Treatment of the Laser Bars and its Influence on the Laser Action

The purpose of the chemical treatment of laser bars is to achieve a sufficiently smooth surface without any imperfections resulting from the mechanical processing.

The chemical polishing process is based on a reaction of the glass components with a mixture of the sulphur acid and the fluorohydrogen acid. This polishing mixture etches the microirregularities of the surface and makes the glass smooth and transparent. The way of chemical polishing of the glass is much quicker than the traditional mechanical polishing.

The chemical method of glass treatment has been applied in the Institute of Quantum Electronics, Technical Military Academy, Warsaw, Poland, to the laser bars processing, which are produced of neodynium glass of the type SL-100, SL-154 and SL-156 (Polish make) as well as those of German production, i.e. LG-56, LG-54, and LG-52. Depending of the chemical composition of the glass, the proportion of the sulphur acid and fluorohydrogen acid in the mixture has been determined as well as the proper polishing mixture temperature and the proper submersion time for the laser bars defined.

For comparison of the laser of the different treatment influence a number of laser bars has been produced according to both the traditional and chemical methods, the latter being applied to the flank and fronts of the cylinder.

As a result of the investigation carried out the total time of the laser bar processing has been shortened. The surfaces obtained were of quality not poorer than those treated mechanically. Additionally, the stress usually associated with the mechanical treatment has been avoided.

The investigations were carried out by two groups of investigators concerning the behaviour of laser rods processed by a chemical method in two different laser systems. The examinations pointed out that:

1. Laser radiation generated with the used of a chemically treated rod happened to be less divergent than that generated by a mechanically polished rods.
2. Threshold energy was the same in both cases.
3. Energetic efficiency of the laser rod with the chamically processed flank and front surfaces was greater.

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