Temperature Model of a New High-powered $SrBr_2$ Laser

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It has been established that laser generation with wavelength of $\lambda = 6.45\mu$m is widely applicable in the fields of medicine and biology. The main sources of this radiation were free electron lasers. Due to their high cost an alternative - $SrBr_2$ vapor lasers, which generate the same wavelength - was developed. They have a number of advantages – compact size, lower price, easy operation, longer tube service life. The operating temperature of $SrBr_2$ vapor lasers is 1000°C. This places special demands on the construction of new laser sources of this type. Up to this moment, the achieved laser output power is 4.26 W, with 90% of generation along the line $\lambda = 6.45\mu$m. In order to develop a new $SrBr_2$ vapor laser (with an expected output power 6-7 W), a preliminary evaluation of the temperature profile of the active laser medium and the laser tube is necessary. To this end, this paper utilizes a temperature model developed by the authors beforehand. Two types of laser tubes of similar geometric size but with different geometric structures of their cross-sections have been considered. For each of the two tubes, families of temperature profiles with variation of the input electric power, buffer gas pressure, and external wall temperature, have been developed.

Obtained results are part of the general preliminary studies for developing the new high-powered $SrBr_2$ vapor laser. They allow the evaluation of the electric supply, the optical resonator, and the mechanical construction. The application of statistical methods for the prediction of laser generation will be also stipulated. The optimal temperature profile of the future device and its geometric design can only be determined in the context of the general analysis.

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