Automated measurement of functional parameters for fast- and slow axis collimator lenses for high-power diode lasers

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ABSTRACT

The high-power diode-laser industry is dependent on highly qualified production output for fast axis (FAC) - and slow axis (SAC) collimator lenses in scalable quantities. The functional parameters such as residual divergence, power-efficiency, and heat distribution in the collimator lenses are crucial for the customer-related use and application. Therefore, systems have been set up for measuring the above functional parameters. The approach for qualifying the FAC is based on diode laser collimation by active alignment and automated positioning of the FAC in collimation position for the fast axis and simultaneously imaging in the slow axis with an anamorphic autocollimator, allowing for evaluation of the collimation performance with a specific installed diode laser on individual emitter intensity profiles. The thermal image measurement is performed using beam deflection on a gold reflector to observe the lower cross-section of the lens. The approach for qualifying the SAC is based on the same optical setup with the autocollimator rotated by 90°. This rotated setup allows us to measure a SAC lens in the collimation direction and simultaneously use the imaging lens to increase the sensitivity. Another difference is related to the lower position sensitivity, where the FAC's have to be aligned actively - the SAC's can be aligned passively and therefore, the grade of automation and the number of involved axes are different. We present automated setups to measure functional parameters for FAC and SAC lenses and their limitations regarding automation.

Keywords: micro-optics, high-power diode-laser, beam shaping, fast axis collimation, residual divergence, effective focal length, slow axis collimation, automation, active alignment