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Results on the high power testing of screen-printed deformable mirrors

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Abstract content :

The performance of high power laser systems is affected thermal lensing. Deformable mirrors have been applied for the compensation of these thermal lensing effects. Difficulties can arise as not only the optical properties of lenses and mirrors in the beam path are affected by thermal lensing, but also deformable mirrors itself. The radiation of a high power laser beam is partly absorbed by the deformable mirror surface and transferred into heat. Mirrors temperature is increased leading to laser-induced mirror deformations. These deformations need to be analyzed to evaluate the applicability of a deformable mirror in high power systems. This paper gives results on the high power testing of our MOEMS screen-printed deformable mirrors.We introduce the measurement set-up based on a 1 kW laser beam that is incident on the deformable mirror. The deformable mirror is equipped with a dielectric coating that offers a reflectivity of 99.4 % at 1070 nm in order to allow for the application in high power systems. The high power laser beam is expanded to a diameter of 20 mm to match the mirror's aperture. Subsequently, the beam is compressed to the wavefront sensor's aperture to measure the laser-induced aberrations. We measure the overall laser-induced mirror deformation and also give results on their temporal behavior. The laser-induced mirror deformation is only few micrometers in case of 1 kW laser load.The design of the deformable mirror allows for a compensation of the laser-induced deformations by mirror heating. The temperature-induced deformation rate is -1µm/K. In the next step, we demonstrate the further minimization of the laser-induced deformations by mirror heating und demonstrate the applicability of the screen-printed deformable mirror for high power applications.

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