

论文

液滴透镜在电场中的变形研究

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摘要:

利用电场作用操控液滴面形获得非球面液滴透镜,并实时检测其光学性能,利用紫外光固化技术使液滴透镜固化得到固体非球面透镜.实验测量了液滴透镜的面形并经过图像处理提取面形轮廓,经多项式拟合得出液滴透镜的面形表达式.比较了不同强度电场作用下的液滴透镜面形,计算了主曲率随电场的变化规律,讨论了液滴透镜在电场中的变形机制.根据透镜面形表达式,采用光线追迹法得出了液滴透镜的焦距随电场的变化规律,结合ZEMAX软件计算了3 550 V时液滴透镜的最大波像差为0.32个波长,Strehl Ratio为0.74,及光学传递函数等参数,计算了所制作的非球面透镜的像差,为低像差非球面透镜的研制提供了依据.

关键词: 微光学 液滴透镜 电场作用 非球面透镜

Deformation of Liquid Lens in Electrostatic Field

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Abstract:

A new method of fabricating aspherical liquid lens by employing electrostatic forces to manipulate the shape of the liquid polymer lens with real-time measurement is proposed.The liquid lens shape has a deformation from spherical to parabolic and to near cone with the increase of the electrostatic force.Surface profiles of liquid lens in different electrostatic fields are compared and the mathematic expressions of the surface profiles are achieved by polynomial fitting.The variation of the lens principle curvatures is calculated and the mechanism is discussed.The focal lengths of liquid lens in different electrostatic fields is calculated by ray tracing method.The focal length decreases with the increase of the electrostatic force.Calculated by employing ZEMAX software,the max wave aberration of the aspherical liquid lens in 3 550 V electrostatic field is 0.32λ ,and the Strehl Ratio is 0.74.And also,the Optical Transfer Function is calculated.The results are useful for the fabrication of aspherical liquid lenses with fine optical performance.

Keywords: Micro optics Liquid lens Electrostatic force Aspherical lens

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