

Improving the efficiency and quality of mechanical polishing in sapphire aspherical surface production by ultra-precision grinding

Qingliang Zhao^{1, #}, Sheng Wang¹

¹ Center for Precision Engineering, Harbin Institute of Technology, Harbin, 150001, China
Corresponding Author / Email: zhaoqingliang@hit.edu.cn, TEL: +86-0451-86402683, FAX: 86-0451-86415244

KEYWORDS: Sapphire aspherical surface, Ultra-precision grinding, Mechanical polishing, Subsurface damage, Grinding marks, Uniform removal

Abstract: The traditional aspheric manufacturing process consists of grinding, lapping, and polishing. The high hardness and high brittleness of sapphire makes it difficult to remove brittle fracture damage and grinding marks from the grinding process by subsequent lapping and polishing. The lapping process to remove damage and marks may also further degrade the profile accuracy. The use of ultra-precision grinding to reduce the damage depth and marks amplitude of sapphire aspheric surfaces is a recommended solution. Meanwhile, ultra-precision grinding can also provide better profile accuracy, which will also significantly reduce the time required to correct the profile accuracy during the polishing stage. From the above, this study consists of two main parts: on the one hand, it investigates the effect of damage and marks in sapphire ultra-precision grinding on the subsequent mechanical polishing process. On the other hand, it studies the uniform removal polishing process of the preserved profile accuracy after ultra-precision grinding of sapphire. Finally, the polishing process of profile accuracy preservation, damage removal and marks removal after ultra-precision grinding of sapphire aspherical surfaces is realized. The research can significantly improve the production efficiency and quality of sapphire aspherical surfaces, thus expanding their applications in optical systems.
