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现代应用光学

反应连接230 mm口径RB-SiC反射镜

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摘要： 针对传统工艺难以制备口径大于1.2 m的整块反射镜的问题,提出了反应连接制备大口径RB-SiC反射镜的工艺。该工艺在素坯阶段实现连接,一次反应烧结完成坯体的致密化和镜体的连接。采用该工艺制备了230 mm口径的RB-SiC反射镜,并使用FSGJ-2光学数控机床对反射镜进行了研磨、粗抛光和精抛光加工,其镜面面形精度RMS值达到了$\lambda/50$(λ=632.8 nm)。在环境温度(20±3) ℃检测了连接反射镜,其面形变化RMS值小于$\lambda/300$,热循环试验前后连接反射镜面形没有明显变化;连接镜体表面在焊缝处粗糙度R_a<3.3 nm,连接层与基体的显微结构基本相似,热性能相匹配。研究结果表明,用新型反应连接技术制成的RB-SiC反射镜可以满足空间光学应用要求。

关键词： 反应连接 碳化硅 RB-SiC反射镜 表面轮廓

230 mm aperture RB-SiC mirror by reaction-formed joint

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Abstract: As the aperture for a monolithic mirror was limited in 1.2 m by traditional technologies, a new reaction-formed joint technology for RB-SiC was proposed. With the proprosed technology, the SiC mirror was joined in the green body process, and the green body densification and the joint of mirror were finished in the same sintering process. A 230 mm diameter RB-SiC mirror was fabricated by this technology. After milling and polishing finely with the FSJG-2 facility, the figure error of the mirror surface is less than $\lambda/50$(λ=632.8 nm). The mirror was tested in the temperature range of (20±3) ℃, and the tested results show that the change of the figure error of the mirror surface is less than $\lambda/300$, and the mirror surface figure is not changed obviously after the thermal cycle test. Moreover, the roughness of the surface near the joint line is 3.3 nm, and its microstructure is similar to that of the RB-SiC ceramic. The thermal property of welding line is matching with that of RB-SiC ceramic. Obtained results demonstrate that the reaction-formed joint technology for the RB-SiC mirror satisfies the need of the large aperture mirror used in space optics.

Keywords: reaction-formed joint SiC RB-SiC Mirror Surface profile

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