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微纳技术与精密机械

大型衍射光栅刻划机刀架系统的设计

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摘要： 设计了一套光栅刻划机刀架系统。该系统将刻划刀具部分安装于能绕鞍形滑块自由转动的安装板上，利用铰链机构来实现了刀架刻划部分与承重部分的分离，降低运动中鞍形滑块的变形、偏移等对金刚石刻刀的影响。分析了刀架运动中产生的误差以及该误差对金刚石刻刀的影响。提出了一种新型检测光路结构，该结构利用双频激光干涉仪测量运动中刀架相对于导向导轨的位移变化。结果显示，刀架单向行程约70 mm时，刀架在光栅刻划阶段相对于导向导轨在分度方向的最大位移值约为60 nm。由于在刻划阶段，膜层对金刚石刻刀存在约束作用，所以金刚石刻刀相对于导向导轨的实际位移会更小。利用新的刀架结构刻制了一块70 mm×70 mm，600 gr/mm的衍射光栅，对比利用原刀架结构刻制的光栅，该光栅杂散光强度减弱，质量提高。

关键词： 光栅刻划机 刀架系统 双频激光干涉仪 检测光路

Design of diamond carriage system for large diffraction grating ruling engine

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Abstract: The diamond carriage system of a grating ruling engine was designed. The diamond lifter part was installed on the plate which could be free to revolve around the saddle-shaped slider. The diamond lifter part and the load-bearing part were separated by the hinge to reduce the error of the diamond position caused by the saddle-shaped slider's deformation and offset. The movement error of the diamond carriage as well as its influence on the diamond position were analyzed, then a optical detection structure was proposed to measure the displacement of the diamond carriage relative to the guide rail at the movement stage by a dual-frequency laser interferometer. The measuring results at the stage of about 70 mm show that the maximum displacement of the diamond carriage relative to the guide rail is up to 60 nm in the ruling stage. As the diamond is constrained by the coatings, the error of the diamond position is even more less. A diffraction grating with 70 mm×70 mm area and 600 gr/mm has been ruled with the changed diamond carriage and it shows a weaker stray light and good quality as compared with traditional gratings.

Keywords: Grating ruling engine diamond carriage system Dual-frequency laser interferometer detection path

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