

[구AT-06] Removal of mid-frequency error from the off-axis mirror

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Manufacturing of lens and mirror using Diamond Turning Machine (DTM) offers distinct advantages including short fabrication time and low cost as compared to grinding or polishing process. However, the DTM process can leave mid-frequency error in the optical surface which generates an undesirable diffraction effect and stray light. The mid-frequency error is expected to be eliminated by mechanical polishing after the DTM process, but polishing of soft surface of ductile aluminum is extremely difficult because the polishing process inevitably degrades the surface form accuracy. In order to increase its surface hardness, we performed electroless nickel plating on the surface of diamond-turned aluminum (Al-6061T6) off-axis mirrors, which was followed by the 6-hour-long baking process at 200 °C for improving its hardness. Then we polished the nickel plated off-axis mirrors to remove the mid-frequency error and measured polished mirror surfaces using the optical surface profilometer (NT 2000, Wyko Inc.). Finally, we ascertained that the mid-frequency error on the mirror surface was successfully removed. During the whole processes of nickel plating and polishing, we monitored the form accuracy using the ultra-high accurate 3-D profilometer (UA3P, Panasonic Corp.) to maintain it within the allowable tolerance range (< tens of nm). The polished off-axis mirror was optically tested using a visible laser source and a pinhole, and the airy pattern obtained from the polished mirror was compared with the unpolished case to check the influence of mid-frequency error on optical images.