

Development of the Retroreflector on the Moon for the Future Lunar Laser Ranging

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Lunar Laser Ranging (LLR) data are important for the investigations of the lunar rotation, tide, and lunar deep interior structure. The range accuracy of LLR has been less than 2 cm for the last 20 years due to the progress of laser transmit/receive system on the ground stations and the atmospheric signal delay model, however, one order or more accurate ranging than 2cm is needed for better understanding of the lunar deep interior. We are developing 'single aperture and hollow' retroreflector (Corner Cube Mirror; CCM) to be aboard future lunar landing missions. The aperture of CCM is 20cm because the reflection efficiency of that size is found to be higher than that of Apollo 11 array CCP (Corner Cube Prism). For the CCM ultra low expansion glass-ceramic (ClearCeramRZ-EX, OHARA Inc.; hereafter CCZ-EX) or 'single crystal Si' is selected for candidate material of CCM taking into account small $|\text{CTE}|/K$ (Thermal expansion coefficient over thermal diffusivity) and large specific Young modulus. The optical performance of CCM deformed by lunar gravity or solar illumination in the holder model is presented for some cases.

Keywords: LLR, corner cube mirror, hollow, single crystal Si, deformation, optical performance