Introduction: A space environment simulator for the lunar surface is very helpful in developing ISRU technology available on the Moon. We can verify the technology in a more similar conditions to the actual lunar surface environment, which not only improves the reliability of the technology, but also increases the probability of mission success. The lunar surface is covered with rough and fine lunar soil known through the Apollo mission. Since ISRU is closely related to the lunar soil covering most of the lunar surface, a thermal vacuum chamber with lunar soil can be quite effective in developing ISRU technology. The Korea Institute of Civil Engineering and Building Technology (KICT) is developing a Dirty Thermal Vacuum Chamber (DTVC) containing a large amount of a lunar soil simulant for verification of ISRU technology on the moon. The DTVC, with an internal volume of 50 m³, can be used to verify the full-scale ISRU equipment, which will improve the completeness and reliability of the developed technology.

Pilot DTVC: a pilot DTVC, with an internal volume of 1 m³, has a similar configuration to the DTVC. The pilot DTVC is designed for technical verification and operation procedure development to be applied to DTVC. When the chamber is pumping down with soil, soil boiling or soil disturbance phenomenon occurs. To prevent this, the evacuation rate should kept below a certain value [1]. We have applied devices to adjust the evacuation rate of the chamber and are studying the optimal pumping down rate to prevent soil disturbance. We are also studying on soil pre-conditioning procedure to reduce time to reach the target pressure of the chamber by reducing the outgas from the soil.

DTVC: KICT is the process of constructing a large-scale lunar surface environment simulator based on the technology and experience obtained from various experiments using the pilot DTVC. The DTVC is in the form of a mailbox with inner dimensions of 4m (W) × 4m (H) × 4m (D). The main processing chamber was manufactured at the end of 2017, and thermal shrouds and heating lamp will be added to the main processing chamber in 2019. The DTVC is capable of creating under 10⁻⁴ mbar pressure, -190 ~ + 150 °C temperature with 25 tons of soil. The DTVC is expected to be available for a rover's driving testing, drill testing, regolith sintering testing, and various ISRU technology verification since its completion in 2020.