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Development of Vacuum Calibration Apparatus for Planetary Exploration

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The growing numbers of missions for exploration of deep space environment has put forward complicated challenges for the field of vacuum metrology. Some suggests that to use 'shield' for protection of the vacuum gauges from external environment, especially temperature which affect the vacuum manometer reading significantly. However, the shield leads to increased mass, volume, power consumption at the expense of reduced reliability of the gauge. To develop less complicated gauges with stable performance, it is necessary to calibrate the vacuum gauges according to predicted working conditions rather than solely rely on laboratory parameters such as room temperature and single gas species. This study reports on a newly developed vacuum calibration apparatus for simulation of space environment. It is composed of gas supply system, pump system, temperature control system, pressure measurement, calibration system, bake system, data acquisition and control system. Through two years of experimentation, it can meet the requirements for calibration of vacuum gauges intended for planetary exploration. This work is beneficial for space technology but also industrial production. Our group is working on improving the design for greater accuracy.

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