



BAKEOUT FACILITY FOR THE CLEANING OF OPTO-MECHANICAL COMPONENTS

Task

In close cooperation with Airbus Defence and Space (ADS) GmbH in Ottobrunn, Fraunhofer ILT is building a so-called »bakeout facility« to clean the components of the laser for MERLIN, a satellite-based methane LIDAR climate mission. While some components can be cleaned manually, others cannot. For them, the bakeout process uses a controlled outgassing process – which is generated under vacuum and by heating the components – to remove molecular contamination from them. This process is attractive when highly integrated and complex components have to be cleaned and when doing so manual alone does not guarantee that the components are uncontaminated.

Method

The vacuum chamber of the bakeout facility has a volume of 750 x 750 x 750 mm³, in which a pump system can generate a vacuum of $\leq 1E-6$ mbar. Heating resistors are used to heat the components to be cleaned so that temperatures of up to 120 °C can be reached. A so-called »Thermoelectric Quartz Crystal Microbalances (TQCM)« sensor is used to measure the remaining contamination. Fraunhofer ILT designed and set up a cold trap to prevent the TQCM sensor from falsifying measurement results when there is high build-up of contamination. This cold trap consists of multistage Peltier elements and the facility's mechanical system.

Results

Currently, the bakeout facility can generate pressures of down to 4E-7 mbar and heating temperatures of up to 100 °C. With the Peltier element-based cold trap, temperatures as low as -40 °C could be demonstrated. In the future, heating temperatures of 120 °C and cold trap temperatures of -45 °C shall be tested. To validate the bakeout process and the cleanliness of the plant, ADS Ottobrunn and Fraunhofer ILT will carry out evaluation and acceptance tests in the next months.

Applications

Bakeout facilities are important plants that ensure flight hardware for space travel is free of contamination. Since they reach high cleanliness standards, these facilities can also play an important role in the construction of solid-state lasers, frequency converters, UV optics or high-power ultra-short pulse lasers.

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