Device

Non-contact levitation technology in a vacuum environment using ultrasonic vibration

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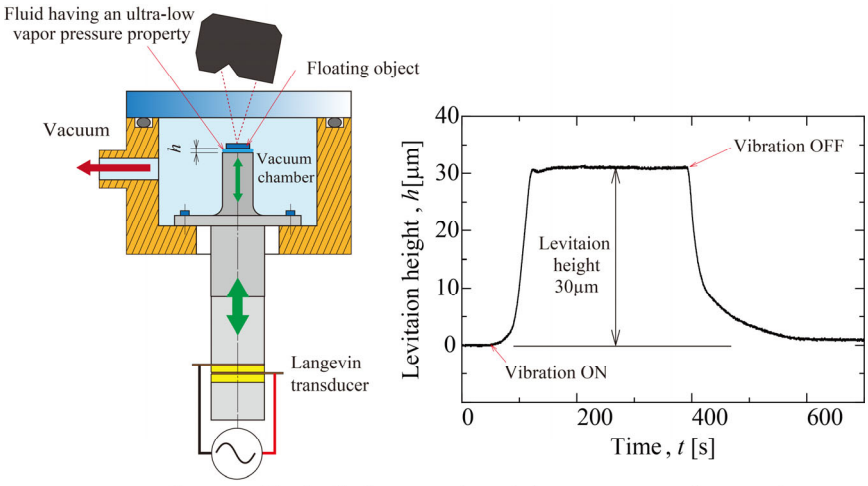
Purpose of Research

There are many demands for non-contact levitation of objects in space environments and semiconductor manufacturing processes in a vacuum. In this study, we have applied a non-contact levitation technology using ultrasonic vibration to non-contact levitation in a vacuum environment. At present, non-contact levitation of a plate object in a vacuum environment has been achieved. In the future, non-contact levitation of a rotor is planned to be attempted.

Summary of Research

Non-contact levitation technology using ultrasonic vibration is a phenomenon in which the time-averaged pressure in the levitation gap between the levitated object and the relative surface becomes higher than the ambient pressure when the surface is vibrated at a vibration frequency in the ultrasonic range, also known as squeeze film levitation. Typically, a gas (mainly air) is used for squeeze film levitation, but air cannot be used in a vacuum environment. In this study, research is being conducted on squeeze film levitation in a vacuum environment using liquids with extremely low vapor pressure, such as vacuum pump oils and ionic liquids.



Squeeze film levitation experiments in a vacuum environment

Comparison with Conventional or Competitive Technologies

Compared with conventional technology, the simple structure and external equipment enable non-contact levitation in a vacuum environment.

Expected Applications

As the load during non-contact levitation is relatively small, it is suitable for levitating small, lightweight objects in a vacuum environment.

Challenges in Implementation

Non-contact levitation of plate-type objects has already been achieved, and now non-contact levitation of a rotor is being attempted.

Points

- Convenient construction enables non-contact levitation in vacuum environments.
- Reduction of wear compared to conventional contact bearings.

What We Expect from Companies

This research is a topic that has just started and is not aimed at a specific application. We look forward to working with companies that are willing to cooperate with us on a wide range of topics, including the introduction of applications (uses) for this technology.

Future Developments

2024.10 Non-contact levitation of a plate object (achieved).
2025.11 Prototype and evaluation of a journal bearing for a rotor (planned).
2026 Non-contact levitation of a rotating shaft in vacuum (planned).

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