

■ Research Highlights

Piezoelectric actuator for cryogenic temperature

Piezoelectric actuators find a wide range of applications in scientific instruments and industrial equipment. This is because piezoelectric actuators can generate large stress, have simple structures and are not significantly affected by external electromagnetic fields.

Certain types of scientific instruments using electromagnetic fields and operating at cryogenic temperatures require small piezoelectric actuators. However, the piezoelectric effect—namely the magnitude of change in the size of the piezoelectric material with applied electric field—is very small at cryogenic temperatures and materials exhibit nonlinear temperature-dependent properties under these conditions. Therefore, it is difficult to use piezoelectric actuators under cryogenic temperature conditions.

Now, Daisuke Yamaguchi, Takefumi Kanda, and Koichi Suzumori at Okayama University have fabricated a piezoelectric actuator operable at cryogenic temperatures.

The actuator is an ultrasonic motor, which is one kind of piezoelectric actuator. The motor consists of a rotor and a vibrating transducer. The structure of the transducer consists of a bolt-clamped Langevin-type vibrator, and was designed with evaluating thermal stress on the transducer.

The vibration of the transducer and the rotation generated in the motor were evaluated under cryogenic conditions. The motor was successfully driven in 4.5 K helium gas.

This type of actuator could find applications for scientific and industrial instruments that use electromagnetic field at cryogenic temperature conditions.



Figure caption: Transducer of piezoelectric actuator for cryogenic temperature.

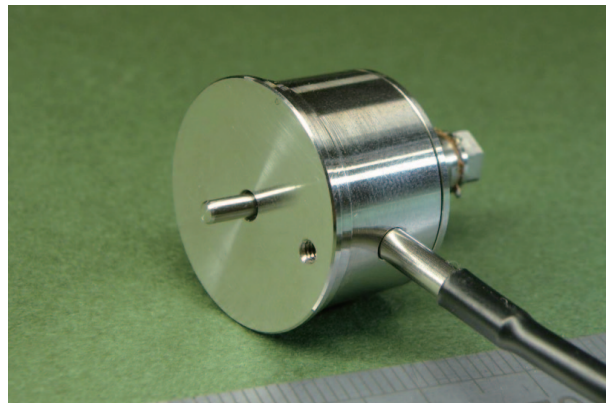


Figure caption: The piezoelectric actuator fabricated for cryogenic temperatures.

Reference:

- Authors: Daisuke Yamaguchi, Takefumi Kanda, and Koichi Suzumori.
- Title of original paper: An ultrasonic motor for cryogenic temperature using bolt-clamped Langevin-type transducer.
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