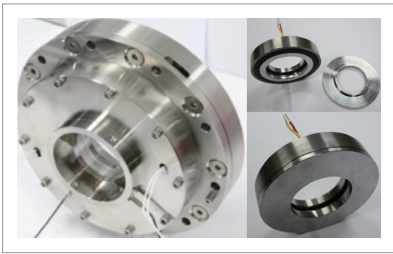


Ultrahigh-speed High-precision Magnetic Bearing Technology

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➤ Magnetic bearing technology using the principle of magnetic levitation for the rotor to rotate in the state of complete levitation to enable high-speed rotation at 100,000 rpm or faster and high-precision rotation with rotating vibration below 2 μm

Client / Market

- Magnetic bearing manufacturer
- Turbo machine (compressor, blower, turbine, pump) company
- High-speed spindle company, ultracentrifuge company
- Precision roller (for printed electronics, nano imprint) manufacturer and application company

Necessity of this Technology

- Existing ball bearing has limits regarding high-speed and precision of rotary machine.
- When applying ball bearing for a rotor with a diameter of 50 mm, rotation at up to 30,000 rpm can be achieved.
- In the case of a low-speed precision roller where ball bearing is applied, rotating vibration of 20 to 40 μm occurs.
- To develop a high-speed, high-precision rotary machine with rotating speed over 100,000 rpm and rotating vibration of 2 μm, a magnetic bearing that enables contactless rotation in the state of complete levitation needs to be applied.

Technical Differentiation

- Energy efficient magnetic bearing using a permanent magnet and electromagnet
- Homopolar structure to eliminate the high heating issue of heteropolar magnetic bearing
- The volume of entire system reduced by integrating the auxiliary bearing and sensors with magnetic bearing and achieving a shorter length for magnetic bearing
- With a short length for rotor, the primary bending mode frequency can be increased for enhancement of rotation stability at high speed.
- Minimization of usage of the electric current and rotational vibration by applying self-weight compensation and permanent magnet for bias force
- Lubricant is not required because it is contactless and frictionless, and clean bearing of which life time is semi-permanent
- Smart bearing with real-time vibration/load monitoring to cope with dangerous situations

Excellence of Technology

- Applied for an ultra-high-speed spindle with rotor with a diameter of 41 mm and achieved rotation speed of 120,000 rpm and linear velocity of 49.2 Mil-DN
- Applied for a low-speed high-precision roller and achieved rotation speed of 30 rpm, and rotating vibration below 2 μm under the condition of 300 N load
- External vibration and load is monitored real-time to detect abnormality in system in advance.

DESIRED PARTNERSHIP

Technology Transfer

Licensing

Joint Research

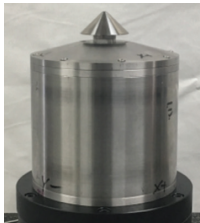
Other



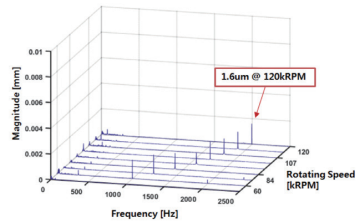
TECHNOLOGY READINESS LEVEL [TRL]

- Research, basic explanation Project concept or idea development Technology idea verification Prototype development Trial product production/evaluation in similar environment Pilot field demonstration Development and optimization of commercial model Commercial product demonstration Mass production and initial market launch

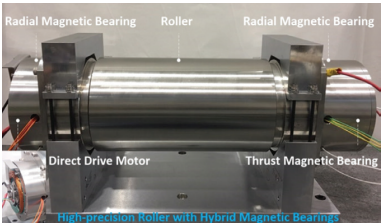
Ultra-High-Speed Spindle with Rotating Speed of 120,000 rpm



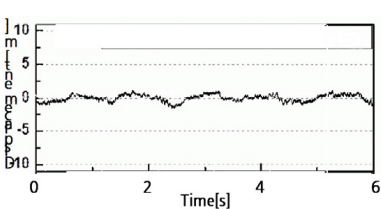
Radial Vibration at Rotating Speed of 120,000 rpm



Precision Roller with Magnetic Bearing



Rotating Vibration Under 30 rpm, Load of 300 N



Current Intellectual Property Right Status

PATENT

- Turbo Machine Equipped with Magnetic Bearing (KR1287057)
- Magnetic Bearing Using Permanent Magnet and Electromagnet (KR0976631)
- Magnetic Bearing System (KR1133560)
- Magnetic Bearing Structure and Turbo Machine Equipped with this Magnetic Bearing (KR1166854, US9041266, SE536808, CNZL201180013360.X)
- Composite Magnetic Bearing Having Auxiliary Bearing Coupled Thereto (KR1408060, US9273723, CNZL201380006733.X)
- Composite Magnetic Bearing Having Sensor and Auxiliary Bearing Coupled (KR1444139)
- Thrust Magnetic Bearing for Deflecting Force Compensation (KR1552350, US14/674022, CN201510196685.6)
- Roller Module Equipped with Magnetic Bearing and Permanent Magnet (KR1809104, US15/554729, UK1708962.4)

KNOW-HOW

- Ultra-high-speed rotor design, manufacturing technology
- Ultra-high-speed, high-precision magnetic bearing control technology
- Inductive displacement sensor technology
- Real-time vibration, load monitoring and emergency situation handling technology