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## Background of Research

Metal powder sintering 3D printers are not only able to produce durable, complex shapes, but are also able to provide air permeability to arbitrary places of the processed part by adjusting the laser intensity when sintering the metal powder. In this study, we tried to improve the performance of a mechanical element called an aerostatic porous bearing using a metal powder sintering 3D printer, which can not only manufacture parts by adding shapes but also to “add functions,” such as making it air permeable, to arbitrary places of the manufactured part.

## Summary of Research

An aerostatic porous bearing is a mechanical element that floats moving parts of a mechanical device in a noncontact manner by a pressurized film of air, and is widely used for precision processing machines and precision measurement instruments. By utilizing the advantages of the metal 3D printer, it is possible to (1) simplify the structure by integrally manufacturing the porous material and the support structure, and (2) to control the air permeability at arbitrary place of the porous material by adjusting the laser intensity at the time of molding.

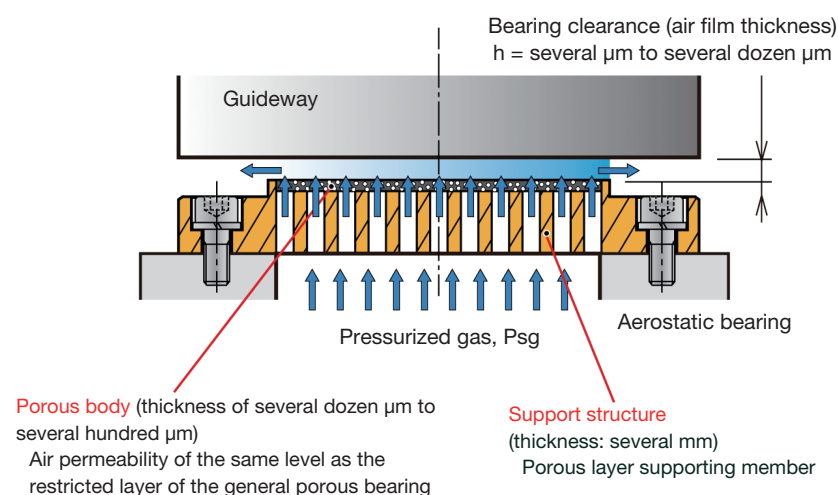


Figure: Aerostatic porous bearings in which the porous layer and the support structure are manufactured integrally using a metal powder 3D printer

## Comparison with Conventional or Competitive Technology

- Porous air bearings currently on the market
  - Fabricated using several mm thick porous material.
  - Surface chocking modification is necessary to prevent unstable vibrations (pneumatic hammer).
  - It is necessary to control air permeability and chocking level of the porous material at the time of mass production, and will be cost consuming.
- New technology
  - The structure is simplified by manufacturing the porous layer to be 1 mm thick or less, and the support structure integrally using metal 3D printer.
  - It is possible to arbitrarily adjust the air permeability of the porous layer during manufacturing.
  - Bearings with higher performance than conventional products can be manufactured.

## Expected Applications

- Guide mechanism of precision processing machines
- Guide mechanism of precision measuring instruments
- Noncontact levitation device

## Challenges in Implementation

- Application to radial bearings supporting rotating shaft
- Optimization of porous layer air permeability
- Cost reduction of metal powder used in the 3D printer

## What We Expect from Companies

- We hope to collaborate with companies that are considering the use of static pressure air bearings in movable parts such as precision processing machines and measuring instruments or the manufacturing of hydrostatic gas bearings.

## Points

- **Simplification of structure by integral manufacturing of porous material and support structure**
- **Control of air permeability at arbitrary places in the porous material by adjusting the laser intensity at the time of molding**

## Future Developments

- Currently, application to radial bearings supporting rotating shaft is proceeding.
- We are working on optimizing porous layer permeability to realize greater performance.

- Intellectual Property: Japanese Patent Application No. 2018-085277  
“Aerostatic porous bearings and manufacturing method of the same”
- Prototype: Available