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The Present and Future of Turbo-Molecular Pumps

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1. Introduction

The turbo-molecular pump, or TMP, especially the magnetic bearing type, is advantageous because it is oil free. This fact has made it extremely popular in the semiconductor industry because the silicon wafers are not subjected to any oily mist in the vacuum chamber during the manufacturing process. In this speech, I will discuss the present and future of the TMP.

2. Present

2-1 Countermeasures Against Reactive Products

Presently, aluminum etching is widely used in TMPs, but reactive products, attaching to the pump and stopping it, have been a problem. Through research we have found that reactive products will not invade the inside of the pump if the internal temperature is raised above 60 degree C. Thus, we were able to solve the problem by maintaining the temperature of the pump with a temperature control system that turns a heater or a valve for water coolant ON and OFF.

2-2 Controller Improvement

The controller of the magnetic bearing type TMP has also been improved.

1) Removing the Battery

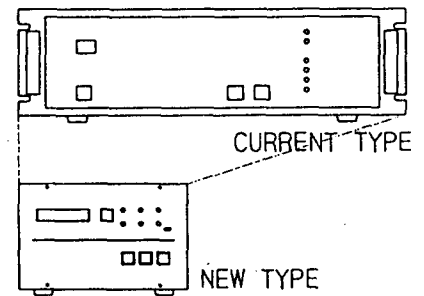
In the past, the TMP has been equipped with a built-in battery, which is replaced periodically, as a backup for when there is a power interruption. However, lately we have been able to remove the battery by harnessing the rotational energy of the motor.

2) Miniaturization

With the removal of the battery and integration of the circuit board, we are working on shrinking the controller down to more than half its present size.

3) Built-in Computer

By building a computer into the controller, it will be possible to auto-tune the controller and pump, to attach a liquid crystal display to show the current status of the pump, and to make maintenance much easier to perform.



CONTROLLER FRONT VIEW

3. Future

Better performance in flow and pressure will be demanded of TMPs in the future.

To realize a significant increase in flow, the rotational speed must be increased; and in order to increase the rotational speed, a new, resilient material, capable of withstanding the centrifugal forces, must be developed.

Better pressure performance means being able to use the pump at higher pressures. The only problem is, if you increase the pressure, the heat of the turbine blades will increase, which will cause a deterioration of the materials ability to withstand the centrifugal forces.

As for reliability, especially the reliability of controlling the magnetic bearing, the method of control must be improved. Toward that end, the employment of a digital control method must be considered.

4. In Conclusion

When thinking about the future of turbo-molecular pumps, the most important area of concern is the material of the turbine blades.

In the semiconductor field alone there this many points to improve, when thinking about other fields as well, it is easy to expect many more developments from the turbo-molecular pump.