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Down-Sizing Clean and Dry Turbomolecular Pumping

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Turbomolecular pumps are widespread in applications ranging from semiconductor processing to scientific instruments. In chemically aggressive applications, multi-axis magnetic turbomolecular pumps backed by robust dry pumps are well known to give the most reliable clean pumping system. Many harsh semiconductor processes such as plasma etch and ion implanation use relatively large vacuum systems based on 5-active-axis magnetic bearing turbomolecular pumps backed by twin-shaft claw, roots or screw dry pumps. However, 5-axis magnetic bearing technology is not usually cost-effective for turbomolecular pumps with speeds of less than about 800 Vs.

furthermore, twin-shaft dry pumps do not economically scale-down to pumping speeds below 30 m^3/hr, making them inappropriate for backing small turbo-molecular pumps. For this reasons smaller systems, especiall those used in cost sensitive scientific instrument applications such as mass spectometry and electron microscopy, tends to use conventional turbomolecular pumps backed by oil-sealed rotary vane pumps.

However, magnetic bearings would bring benefits to many smaller system applications and this paper consider the use of single-axis magnetic bearings in small turbomolecular pumps to provide these benefits at acceptable cost.

The combination of such turbomolecular pumps with recently available obital-scroll dry pumps to provide hydrocarbon-free vacuum in application such as beam-line rough pumping is also discussed.

Finally, the extention of the operating pressure range of magnetic tubomolecular pumps with molecular drag stage to allow the use of alternative, low-cost backing technologies is considered and the performance of such compound molecular pump is discussed.