

Development of Aperture Changeable Aerodynamic Lenses for Nanoparticle Focusing in Wide-range Conditions

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Extended Abstract

As pattern size of semiconductor circuit is decreased, even the nanoparticles are considered as contamination sources which induce serious contamination problems so that reduce the yield of process. Such nanoparticles can be generated during the process without any interaction with outside factors. Therefore yield can be increased with monitoring of nanoparticle concentration during the process. There are many kinds of nanoparticle monitoring methods which can be operated in atmospheric pressure, however, in case of vacuum condition where many semiconductor process are performed, only few method is exist. Particle beam mass spectrometer (PBMS) is a system can measure size distribution of nanoparticles range 5 – 500 nm under low pressure ($> 10^{-3}$ torr). It need collimated particle beams to measure nanoparticle distribution. Aerodynamic lenses designed by Liu et al. (1995) has been widely used to make collimated particle beam for PBMS. It shows high focusing efficiency at the designed condition, but focusing efficiency is changed in other conditions. In this study, we suggest iris diaphragm type aerodynamic lenses which of lens have controllable aperture diameter, so that it can used in several process conditions or multi process monitoring system. It was designed by theoretically based on several non-dimensional numbers. In order to validate aerodynamic focusing effect, numerical simulation was performed using conventional computational fluid dynamics simulator (ANSYS Fluent).

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References

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