Uncertainty and accuracy evaluation of flat-top beam adjusted in-situ particle monitor

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Electronic devices have been developed with a fine and complicated structure as the technology of the display and semiconductor has improved. Accordingly undesirable contaminant particles caused product failure and the decreased yield of the product. Also improvement of process integration due to the demand for high performance parts was opportunity to increase the influence of contaminant nanoparticles on the yield. Measurement and diagnostic system is needed to detect contaminated particles generated in the process or equipment in real time in order to increase the yield of the product. Researchers developed a lot of measurement system such as TEM, SEM, wafer scanner, etc. Among various measurement systems, in-situ particle monitor (ISPM) is pwerful tool to detect contaminant nanoparticles which uses scattering method, and it can measure in real time. However, ISPM is difficult to commercialization because ISPM has low measurement efficiency and high measurement uncertainty caused by Gaussian distribution which is non-uniform beam intensity.

In this study, in order to solve the high measurement uncertainty caused Gaussian distribution, we developed an ISPM which has uniform distribution by applying array lens and rod type lens. We compared the uncertainty and accuracy with conventional ISPM and flat-top ISPM. The uniformity of the flat-top module was 17% higher at the focus spot. Also, ISPM devices with flat-top light distribution have higher accuracy and lower uncertainty. Based on this, it is expected that it will be possible to develop a more accurate ISPM system and commercialize measurement system by applying the improved flat-top module.