# New generation projection optics for ArF lithography

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## ABSTRACT

We have developed an ArF scanner with 0.7NA, the FPA-5000AS2, to meet the requirements of the semiconductor industry. The biggest improvement of this system from the previous model is its projection optics. The new projection lens design allows residual aberrations to be extremely small in order to satisfy the requirements of increasingly severe device production. Furthermore, the aberrations derived from the manufacturing process are minimized in the same manner as conventional i-line and KrF lenses by precisely measuring them with a phase measuring interferometer (PMI). To reduce manufacturing-induced aberrations, we calculate various components of imaging performance at each lens manufacturing process and feed them back to the tuning process. Focusing only on aberration in the expression of root mean square (RMS) can never be sufficient for optimal aberration reduction. Lens performance can be optimally improved by gaining a balance among Zernike terms, which represent aberrations, for critical dimensions of various device patterns. It helps us supply users with a projection lens having performance that meets their requirements. This paper reports on the imaging performance of the new lens for both static and dynamic exposure as well as simulation results using PMI data. It also presents the mechanical barrel system that holds the high performance projection lens, intrinsic birefringence (IBR) of CaF2, and leading-edge ArF lens technologies such as chemical clean technology. And imaging performance of the newest 0.75NA ArF projection lens is demonstrated.