Abstract:
A process flow utilizing the newly installed ASML PAS 5500/300 stepper at CNF was found to be capable of transferring features below the optical resolution limit of 248 nm lithography by using electron beam sensitive resist. The PAS 5500/300 was also used to print and verify feature placements with sub 50 nm accuracy.

Summary of Research:
Research involving zero mode waveguides (ZMWs) requires critical dimensions (CD) of 160 nm or less. Unfortunately, this rests at the very edge of the optical resolution limit of 248 nm KrF lithography.

After exploring a variety of conventional DUV resists, we branched our search to electron beam lithography resists and found that high resolution could be achieved with NEB-31A, a chemically amplified resist produced by the Sumitomo Chemical Corporation. The negative tone and poor etch resistance of this resist lead us to experiment with a metal liftoff process which we have developed to print lines and vias with CDs of better than 145 nm.

Chips for calibration of precision optical detection systems require very accurate feature placement accuracy across a large field of view. The extremely low distortion introduced by the image projection system of the ASML PAS 5500/300 at CNF was used to pattern optical alignment chips with a feature placement accuracy of better than +/- 25 nm at 3 sigma across a 10 mm square die.

For verification purposes, an ASML stepper was used to perform metrology capable of measuring this feature placement accuracy across a wafer.