

Contact line Dynamics in Immersion Lithography- Immersion Hood Development

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Abstract

The optical performance of wafer scanners is improved when a thin water layer is present between the lens and the wafer. In this process water is supplied and extracted below the lens. Due to high speed scanning movements the contact line is deformed, instabilities in the interface occur. This may cause water loss in the form of small droplets at the receding side of the interface. This droplet formation causes several problems and must be avoided. On the other side of the interface bubbles can be entrapped into the liquid, causing imaging defects. Contact line instabilities are dominantly influenced by the surface properties and therefore a good understanding of contact line dynamics in relation to the surface properties is essential for the development of immersion lithographic tools.

ASML has developed a method to maintain a local water bath around the lens area, during the scanning process. Water is supplied and extracted in a ring around the lens, while scanning with velocities above 0.5 m/s. This ring is called immersion hood. Outside the immersion hood no water may be deposited at the wafer surface. The flying height of the immersion hood is 0.1 mm above the wafer surface. Contact line instabilities dominate the maximum scan velocities that can be achieved without water loss and bubble entrapment.

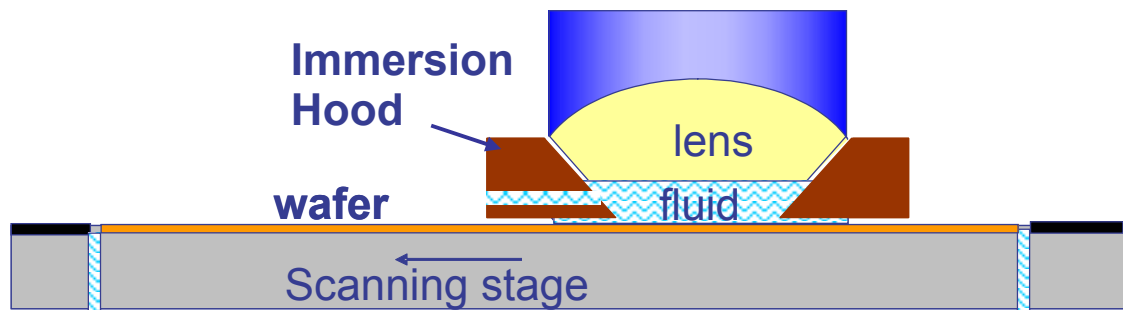


Figure 1, Schematic view of an immersion projection system developed by ASML