Dip Coating of Photoresists

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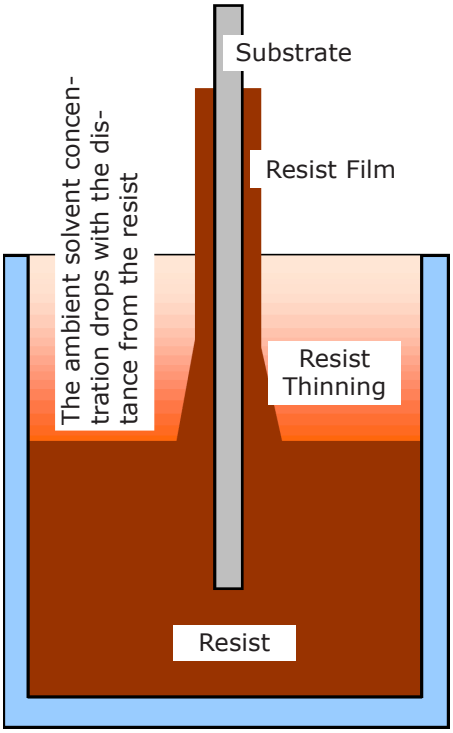
Basics of Dip Coating

During dip coating, the substrate is vertically lifted out of a cuvette filled with resist. The solvent-rich resist film just formed thins out in the solvent-saturated atmosphere above the resist level.

A few mm or seconds later, the low-boiling solvent fraction evaporates from the resist film thereby increasing its viscosity and resulting in a resist film with a specific and constant film thickness. Therefore, the draw rate can be used to attain and adjust the desired film thickness (high draw rate = high resist film thickness).



The resist film just formed thins a certain time in the solvent-saturated atmosphere in the cuvette.

Fields of Application of Dip Coating

Dip coating is a reasonable coating technique whenever the substrate size, weight, or geometry make spin coating hard or impossible to realize.

The high resist yield of dip coating (100% or, respectively, 50% if only one substrate side has to be coated with resist) may be important if the resist consumption is a significant expense factor. However, one has to consider the fact that a certain resist volume is required to fill the cuvette the first time. Due to the high resist yield, an exchange of the resist charge might also be necessary when the resist in the tank expires before its consumption.

Dip coating is not reasonable for applications where a double-side coating, or coating of vias in the substrate, are unwanted.

Dip Coating Equipment

The cuvette bearing the resist should - in all dimensions - be at least few cm larger than the substrate to be coated. For this reason, flat substrates such as metal sheets or wafers require a narrow cuvette design. Increasing the cuvette size is no problem for the coating result, but increases the resist volume required to start with as well as the lifetime of each filling. The cuvette material and all connections have to be stable against all solvents in the resist. Therefore, we recommend HD-PE, Teflon, or stainless steel. In case of delays between dip coating steps, it is recommended that the resist cuvette is covered in order to prevent the evaporation of especially the low-boiling solvent fraction, and the incorporation of particles into the liquid resist.

The substrate suspension must not dip into the resist. Otherwise, the resist will drain off the suspension over the already-coated substrate and hereby cause strong inhomogeneities in the resist film thickness.

The motor lifting the substrate should work continuously and be vibration-free. Otherwise the resist film thickness will show characteristic horizontal, line-like inhomogeneities. For the same reason, the entire dip coater should be arranged vibration-free, and the air stream around the dip coater be constant. The realizable lift velocity should range from approx. 1-

20 mm/s in order to allow a certain range and future adjustments in the resist film thickness.

Dip coating requires a comparably good clean room class, since particles as well as any other contamination from air accumulate in the resist containment over weeks or months. An exhaust near the dip coater helps to keep the solvent concentration in the air below TWA- and lower explosive limit especially for the low-boiling solvent fraction of the resist.

Dip Coating Resists

The process and the required resist film thickness determine the optimum choice of the resin and the photo active compound (-concentration) of the dip coating resist.

The solvent composition of the dip coating resist is very important for a homogenous resist film thickness: Low-boiling solvents cause a fast pre-drying of the resist film thus preventing resist flowing towards the bottom of the substrate. High-boiling (= slowly evaporating) solvents such as PGMEA keep the resist film sufficiently liquid for some minutes, which allows the resist film to smooth.

We supply optimized ready-to-use dip coating resists for various applications - please contact us for further information!