

Wet-Chemical Processes: Cleaning Processes Based on Aqueous Solutions

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Introduction

The purpose of this chapter is to draw attention to the important considerations in aqueous cleaning of semiconductor surfaces.

The basic requirement for cleaning processes is the removal of contamination. Such removal is of paramount importance to semiconductor chip manufacturers since it is generally accepted that over 50% of yield losses in integrated circuit fabrication are due to microcontamination. Furthermore, any metals left on the surface may spread and diffuse into the semiconductor interior and cause yield loss and/or loss of chip function reliability. Whether the contaminants are specific or general, or whether the source of the contaminants is known or unknown, the successful removal of contamination is the essence of cleaning.

Aqueous chemistries involve a variety of solutions which can be made by dissolving a gas, liquid, or solid in water. Aqueous cleaning solutions are currently the most widely used due to their many advantages over alternative processes. Alternatives include cleaning with organic solvents, the application of vapor phase chemistries (both organic and inorganic), as well as the use of various physical and thermal methods of contaminant removal.

Since there are many applications requiring aqueous cleaning in semiconductor manufacturing, with widely differing demands for surface cleanliness, not all of these considerations are important to each application. Nevertheless, in an attempt to address the most pertinent issues, the information in this chapter has been organized under the following headings:

1. Introduction to Aqueous Cleaning
2. Considerations of Contaminants and Substrates
3. Factors Affecting Aqueous Cleaning
4. Cleaning Chemistries
5. An Example of an Aqueous Chemical Cleaning Process
6. The Effect of Process Variables on Aqueous Chemical Cleaning
7. Semiconductor Wafer Drying
8. Equipment Used For Aqueous Cleaning
9. Conclusion