

Following lifting of the first wafer carrier to its end position, the wafer lifter 71, which comprises a wafer engaging projection 74, is extended upwardly relative to the first wafer carrier to lift the wafers off of the carrier into the second wafer carrier in the chamber 14. Following shifting of the chamber to the offset position, the wafer carrier and lifting structure is dried, such as by Marangoni drying accomplished by draining the tank at a rate that optimizes Marangoni drying. After the bath is drained in this example, gas is directed, such as heated N₂ gas from an air knife (234, FIG. 18) toward the lifting structure and first wafer carrier to accelerate the drying of the first wafer carrier to accelerate the drying of the first wafer carrier. The chamber 14 is desirably moved to the offset position 18 at any time prior to directing gas toward the first wafer carrier.

The N₂/IPA vapor is introduced into a dispenser chamber or manifold portion 80 of chamber 14 at the upper end of the chamber 14 for flowing downwardly through the chamber 14 and into the upper portion 36 of the tank 30 at appropriate times during the process. This same gas dispenser can be used to direct gas, such as N₂ gas, into the chamber as and/or after the chamber 14 is moved to the offset and/or recess positions.

In FIG. 2, a plenum 64 is shown along one side of the upper portion of the tank 36 and a plenum 66 is shown at the opposite side of the upper tank chamber. The respective plenums are connected to conduits 68, 77 which direct gas (e.g., IPA vapor and N₂ gas) flowing into the tank to an exhaust for recirculation.

By maintaining the flow of N₂ while the wafers are in the dryer, even following the drying of the wafers, a protective blanket of flowing gas is provided over the wafers.

FIG. 3 illustrates an exemplary deionized (DI) water supply, filtration and recirculation system that can be used in the dryer 10.

With reference to FIG. 3, a DI supply source 100 is coupled to an inlet conduit 102 and through a pressure regulator 104 and control valve 106 to a branch 108. At branch 108, the DI in this example is split into two parallel branches 110, 112 that pass through respective parallel filters 114, 116 to filter the water to the desired level of filtration. Filtered (polished) DI water is delivered to the tank 36 through respective outlets 117, 118 and 120. Outlet 116 in this example is a high flow outlet for process applications where higher DI water requirements are needed. Outlet 118 is a low flow outlet for providing a lower flow DI water supply, such as when the dryer is in an idle state wherein the tank is awaiting wafers. The tank outlet 120 is a rinse outlet that provides DI for rinsing the dryer system.

purposes. N₂/IPA vapor from system 99 is delivered to an outlet 162 for passage to the gas dispenser 80 at the upper end of chamber 14 (FIG. 2). The vessel also has a selectively openable drain line 159 that can be used to drain the vessel 103.

FIG. 6 discloses an exemplary dryer tank plumbing system 161. As can be seen in FIG. 6, the N₂/IPA vapor from the bubbler is delivered via the line 162 to the N₂/IPA manifold or dispenser 80 in chamber 14 (see, also, FIG. 2) and thereby to the tank 30 of the dryer 10. Elements of the dryer that have previously been described in connection with FIG. 2 have been assigned the same numbers in FIG. 6 and therefore will not be discussed further. The low flow DI supply line 118 is coupled through the valves 163, 167 and a flow meter 171 to a line 180. In addition, the high flow DI supply line 116 is coupled through a valve 169 and flow meter 173 to the line 180. Line 180 leads to the DI inlet 38 at the lower portion 34 of the tank 30. DI water entering inlet 38 flows upwardly, as indicated by arrows 182, past wafers in the tank (when wafers are present on a first wafer carrier therein) to the respective weirs 44, 45. The water spills over the weirs (flowing water being indicated schematically at 183) and into respective drain channels 47, 48 and into respective drain conduits 67, 69 and then to the process drain line 124.

During the high flow operation, typically the valves 167, 169 in both the low flow and high flow supply lines are open to increase the flow. In contrast, during the low flow only DI supply process, the valve 169 in the high flow DI supply is typically closed and only the low flow DI supply line is open. A tank drain 184 is shown in FIG. 6 and coupled through respective branches 186, 188 and through respective valves 189, 191 and to the process drain line 124. To drain the tank, the valves 189, 191 are selectively opened. The valves 189, 191 are operated to control the draining of liquid from the bath to, for example, achieve Marangoni drying of the first wafer carrier and lifting structure in the dryer.

FIG. 7 illustrates an exemplary first wafer carrier 42 with a plurality of wafers 40 positioned in respective slots of the carrier. Various alternative carrier types can be used. These carriers are moved from process location to process location and in this case are shown suspended by rods as they are moved. The first wafer carrier can be positioned over the tank access opening 32 (FIG. 2) to the tank and lowered onto the lifter 50 within the tank 30.

FIG. 8 illustrates an exemplary form of wafer lifter indicated generally at 190. The lifter includes a support 192 that carries a tray 194 with respective slotted wafer holders 196, 198 at opposite sides of the tray. As the support 192 is raised away from a first wafer carrier, the wafers are lifted by the wafer holders 196, 198 of the tray 194 upwardly and away from the first