Chapter 6

The Conclusion and Future Work

6.1 The conditions of photoresist removal using SCORR process

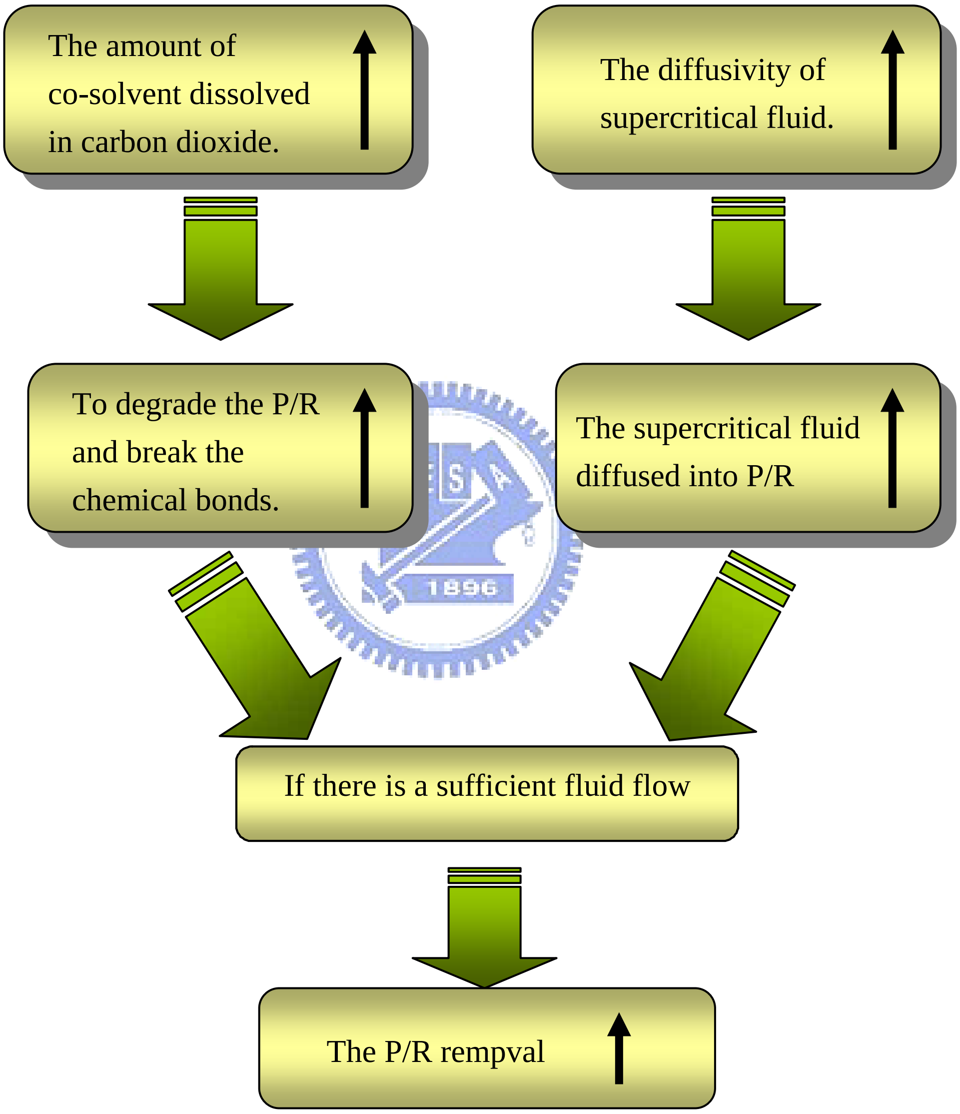

Figure 34 The conditions of photoresist removal using SCORR process

So we have to tune the parameters of pressure and temperature to obtain the optimal condition for photoresist removal

6.2 The job we have to do before the SCORR process

Before the treatment of photoresist and residue removal using supercritical carbon dioxide and co-solvent is preformed , we have to find the conditions（pressure, temperature and the proportion of co-solvent to the supercritical carbon dioxide）to understand that what pressure, temperature, and a amount of co-solvent can result in the co-solvent completely dissolved in carbon dioxide and the solvent mixture is in supercritical phase. And then we can ensure that the co-solvent completely dissolved in carbon dioxide and the solvent mixture is in supercritical phase when the parameters are changed. Similar the critical surface of PCO3-CO_2 mixture（Figure 34 [8]）

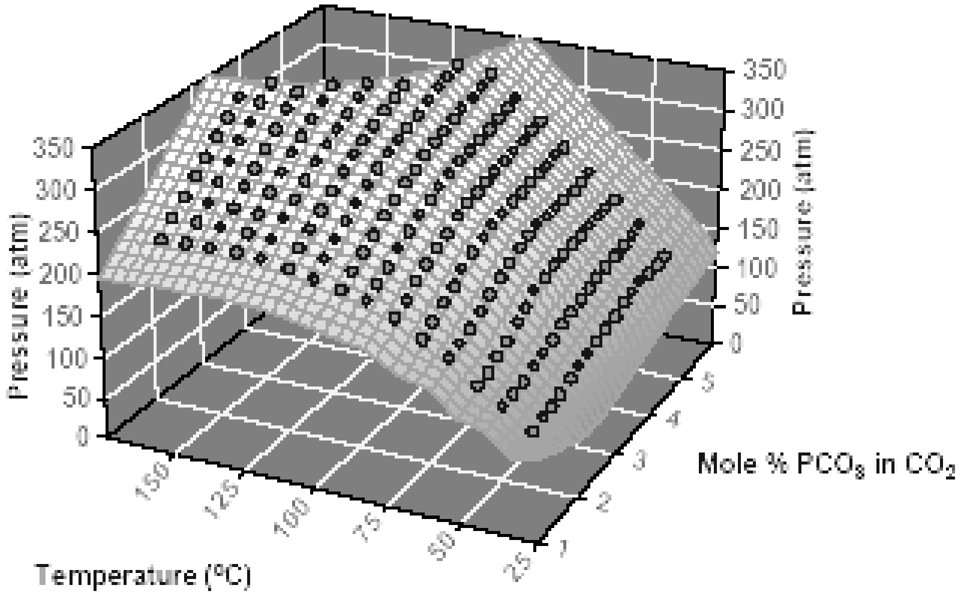

Figure 35 Vapor-liquid critical surface extrapolated from data given in [10]. The PCO3-CO_2 mixture is signal-phace at all conditions above the surface [8].

6.3 The issue of co-solvent remained on the wafer

The co-solvent would be still remained on the wafer after DI water rinsed and N_2 dried, or supercritical carbon dioxide dried. According to some literatures, the bulk photoresist is removed from wafer by the steps of depressurization / repressurization and flush with supercritical carbon dioxide and co-solvent. And then the process continues with a rinse step in which the wafer is rinsed by the supercritical carbon dioxide and a rinse agent. The pressure and the temperature of the rinse step is equal to the soak step. The rinse step is performed for the removal of the residues and co-solvent. There is no involves the studies of rinseing step in this thesis.

6.4 The conclusion

The supercritical fluid processes are a new technology for the semiconductor industry with the capabilities to address the wafer cleaning challenges of nanoscale dimensions. In our studies, we have demonstrated that photoresist can be removed using supercritical carbon dioxide and co-solvent, and this can instead of the process of oxygen plasma ashing.（the existing process for photoresist stripped is using oxygen plasma ashing and wet chemical clean）. The mechanism is a combination of the swelling of photoresist caused by the diffusion of supercritical carbon dioxide and co-solvent into the polymer matrix, a debonding of the film caused by rapid depressurization and sufficient fluid flow to sweep away the debris. By using the appropriate temperature, pressure and co-solvent the process can be selective in the materials it affects. An additional benefit of this process is from an environmental perspective. It allows dramatic reductions in emissions, water consumption and energy use while enabling achievement of the ITRS（Interational Technology Roadmap for Semiconductor）goals.

6.5 Future work

6.4.1 To establish the database as the mention of chapter 6.1.

6.4.2 To find the rinse agent and combine the rinse agent with carbon dioxide to remove the remained co-solvent after flush step.

6.4.3 Photoresist removal using the SCORR process with the different proportion of PCO3 and DMSO.

6.4.4 Photoresist removal using the SCORR process in the structures of high aspect ratio trenches and vias

6.4.5 Using the sufficient fluid flow in flush step to sweep the debonded photoresist.