Title	Photoresist removal by using catalytically generated hydrogen atoms and other species
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Abstract

Photoresist is a light sensitive material which is used in photolithography to form a patterned coating on a surface of substrate. There are several steps in typically photolithography process: substrate preparation, photoresist spin coat, prebake, exposure, development, and postbake. After that, the remaining photoresist should be completely removed.

Currently, there are two classes of photoresist removal techniques: wet removal using organic or inorganic solutions, and dry (plasma) removal. These two have some disadvantages such as oxidation of substrate and metal interconnect. The solutions after the removal process are hard to wash off or bioderage. Both methods are expensive and cause environmental damage. Thus, the request of the new removal method is more and more necessary.

In the new photoresist removal technique, hydrogen gas and diluted gas such as nitrogen or argon are introduced in the vacuum chamber. Hydrogen molecules will be decomposed to hydrogen atoms by the heated tungsten wire as a catalyzer. These atoms have excellent reduction ability. They can react with photoresist film to form $–C_xH_y$ and –OH [5], then will be evacuated. This new plasma – less removal technique (see Fig.) has many advantages and various applications, especially in reducing cost and environmental burdens.

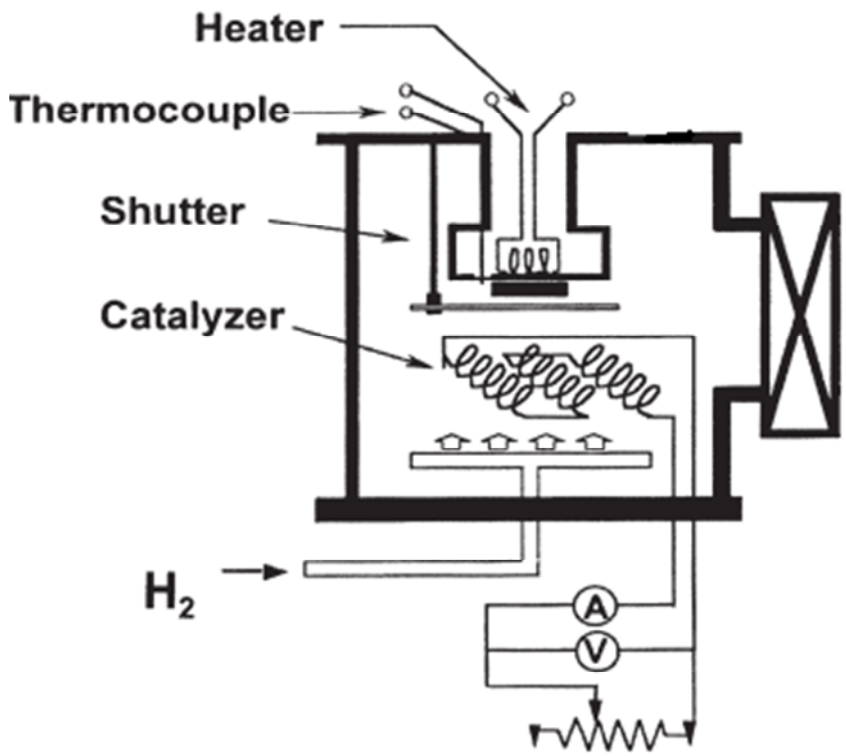

Figure: Schematic of experiment apparatus

The current problem of this new method is that the volatile C-related species after removing from the surface can come back and are likely to convert the surface of W catalyzer to carbonated-W. As a result, the amount of pure W surface is decreased and the efficiency of H generation is also decreased. Thus, the purpose of the research is to measure the removal rate of photoresist film at various conditions of hydrogen treatment, when using only hydrogen gas and when diluting argon gas. From that, we can understand the mechanism of the phenomenon occurring inside the chamber and expect to construct a

system that can be used to remove photoresist at low vacuum, hopefully at atmosphere pressure to solve the problem described above.

This thesis consists of four chapters:

Chapter 1 generally introduces about conventional techniques for photoresist removal and also the new removal technique.

Chapter 2 describes the fundamentals of experiment, how hydrogen atoms can be generated and why they can remove the photoresist. This chapter also introduces the experiment apparatus.

Chapter 3 shows the experiment results and discusses about them. From this chapter, we can more deeply understand the mechanism of the phenomenon occurring inside the reaction chamber.

Chapter 4 is the result summary and some important conclusions drawn from the results.