NEWS RELEASE

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Dainippon Screen Mfg. Co., Ltd.
Kobe Steel, Ltd.

Kobe Steel and Dainippon Screen announced today the two companies will develop next-generation semiconductor fabrication equipment using supercritical fluid technology.

Dainippon Screen Mfg. Co., Ltd. (head office in Kamigyo-Ku, Kyoto; Akira Ishida, President; hereinafter referred to as Dainippon Screen) and Kobe Steel, Ltd. (head office in Shinagawa-Ku, Tokyo; Koshi Mizukoshi, President; hereinafter referred to as Kobe Steel) announced a joint effort to develop next-generation semiconductor device fabrication equipment and production processes using supercritical fluid technology.

Dainippon Screen is one of the 10 largest worldwide suppliers of semiconductor fabrication equipment and is recognized for its development and manufacture of highly reliable process tools. Dainippon Screen is a top producer of photolithography resist coat and develop equipment and is the world's largest supplier of wafer cleaning systems.

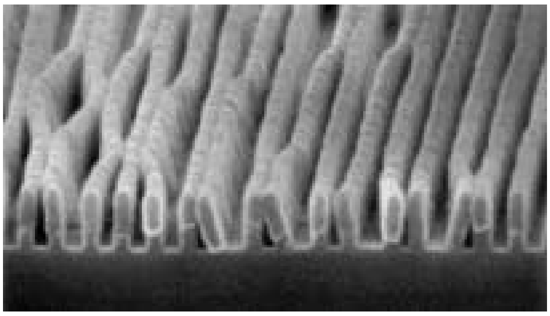
Kobe Steel is the world's leader in supercritical fluid process technology and in the manufacturing of high-pressure contamination-free equipment capable of achieving operating pressures up to 2,000 atmospheres. Dainippon Screen and Kobe Steel will combine their expertise and know-how to collaboratively develop and market semiconductor fabrication equipment and processes using supercritical fluid technology.

Supercritical fluids (Note*1) have unique properties compared to ordinary liquids and gases. They possess densities approaching that of a liquid while having viscosities and diffusivity properties like a gas. These characteristics provide unique characteristics ideally suited for semiconductor wafer cleaning and drying. The Dainippon Screen / Kobe Steel partnership will focus on 3 key areas:

1. The use of Super Critical CO2 ($SCCO_2$) as a post develop drying agent for sub-100nm lithography
2. Wafer cleaning using Super Critical CO2 ($SCCO_2$) enhanced with co-solvents.
3. $SCCO_2$ post-clean drying applications

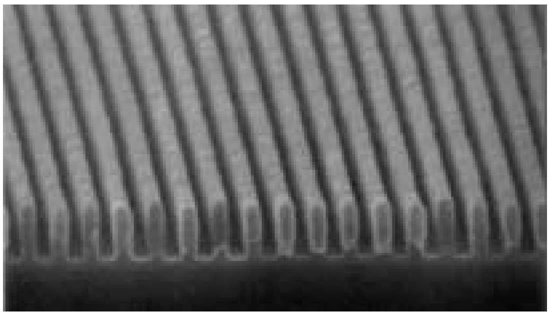
Moore's law predicts that the processing power of integrated circuits doubles every 18 months. Smaller circuit geometries and lower resistance interconnect structures are key technologies enabling this progression. While typical production fabs manufacture devices with 150~180nm features, mass production of IC's with geometries less than 100nm is expected in 2004.

Patterning integrated circuits is generally done through application of a photosensitive chemical (photoresist) onto the wafer. The desired pattern is exposed into the photoresist using laser illuminated optical systems. The exposed pattern is then developed, rinsed in de-ionized water, and dried (spin dry). Conventional processing has limitations in the sub 100nm regime. Photoresist patterns can be destroyed in the drying process due to capillary stress generated by the interfacial tension between two different phases, liquid and gas (Note*2). This phenomenon, known as “pattern collapse”, causes adjacent structures to be wicked together, destroying pattern integrity.



Collapsed pattern

Dainippon Screen and Kobe Steel have successfully employed supercritical CO2 fluid technology in the lithography drying process. The supercritical fluid process eliminates capillary stress induced by liquid-gas phase boundaries and associated interfacial tensions. The effectiveness of this process is well demonstrated in Figure 2, which shows 70nm structures with a 5:1 aspect ratio without any pattern deformation.



Pattern processed with supercritical fluid

In conjunction with advanced lithography development, Dianippon Screen and Kobe Steel are simultaneously developing wafer cleaning and drying processes and equipment. Supercritical fluid cleaning is especially attractive in meeting the stringent cleaning and drying requirements of advanced interconnect dielectrics. The porous structure of these materials requires thorough cleaning of organics and polymer without film hydration (which degrades electrical properties of the film). Supercritical fluids have excellent diffusivity and solvent-like properties for cleaning effectiveness with an inherent drying mechanism that will not hydrate the film or cause deformation of the porous structures.

Environmentally, supercritical CO2 processing has distinct advantages over conventional cleaning processes. Carbon dioxide is a comparatively benign chemical that is readily available and has a relatively low critical point. Additionally, supercritical processing systems provide the capability for CO2 reclaim in addition to consolidated waste discharge (for the small percentage of co-solvents used and material cleaned from the wafer surface).

Dainippon Screen and Kobe Steel will have both 200 and 300mm equipment available for customer demonstration in April 2002. Collectively, the companies will continue to develop, market, and sell semiconductor equipment using supercritical fluid technology.

Note *1: Supercritical fluid

A supercritical fluid refers to a fluid in the supercritical phase. This, by definition, occurs when the temperature and pressure exceeds the compound’s critical point (critical temperature and pressure), which is the maximum temperature and pressure that a liquid/gas phase boundary (for a given material) can exist.

The supercritical fluid has unique advantages which including:

1. Much better diffusivity properties compared to a liquid, allowing the supercritical fluid to penetrate into ultrafine nanostructures.

2. The supercritical fluid produces no capillary stress during the drying process due to the absence of a liquid-gas interface.

3. The supercritical fluid can be used for the extraction or removal of specific materials from nanostructures.

* The critical point of carbon dioxide gas: 7.38 MPa (73 atm), 31.1 degrees Centigrade

Note *2: Capillary stress

If a capillary tube is inserted into water, the water will rise in the tube against gravity, provided that the internal wall of the tube has affinity to water (which is the case with a glass tube). This is known as the capillary effect and the force that causes the water to rise in the tube is called capillary stress.

If two glass plates are wetted with water and placed together, the water will form a thin layer between the two glass plates. The plates will strongly adhere to each other and a significant force will be required to separate them. This is also a result of capillary stress in action. A similar phenomenon occurs in the drying process of wafers with a delicate circuit patterns. The capillary stress is strong enough to cause pattern collapse.