



September 12, 2005

**Mitsui Chemicals Develops a New High Refractive Index Liquid
("Delphi") for
Next-generation Immersion Lithography**

-- Makes Possible Microfabrication of 32-nm Lines and Spaces --

Mitsui Chemicals, Inc. (MCI) today announced development of a high refractive index liquid ("Delphi") for next-generation immersion lithography¹ in photolithographic processing² for semiconductor fabrication. An evaluation by Semiconductor Leading Edge Technologies, Inc.³ ("Selete") confirmed that Delphi enables a resolution of 32-nm lines and spaces (L/S). Details of this evaluation will be presented jointly with Selete at the 2nd International Symposium on Immersion Lithography, which began today in Belgium.

Today, 130-nm semiconductor devices are the mainstream, with 90-nm devices at the cutting edge. However, R&D continues on even finer lines. Generally it is said that finer lines contribute to more powerful semiconductors and smaller electronic devices. For example, 32-nm lithography would make possible 32-gigabit dynamic random access memory⁴ (DRAM) with 16 times more memory than the mainstream 2-gigabit DRAM manufactured using 130-nm design rules.

In developing next-generation immersion lithography technology, most companies in the industry are working on design rules from 65-nm down to 45-nm using water, which provides a refractive index of 1.44. Delphi, a cyclic hydrocarbon compound, provides a higher refractive index than water of 1.63, thereby facilitating 32-nm semiconductor devices.

Under its New Medium-term Business Plan, covering the period between Fiscal 2005 and Fiscal 2008, MCI aims to expand and grow in the field of Performance Materials, comprising functional polymers, information and electronics materials, and healthcare materials. In particular, information and electronics materials focuses on forming and expanding clusters of various new products to augment the lineup of existing core products. MCI therefore aims to make Delphi commercially viable as a new semiconductor material.

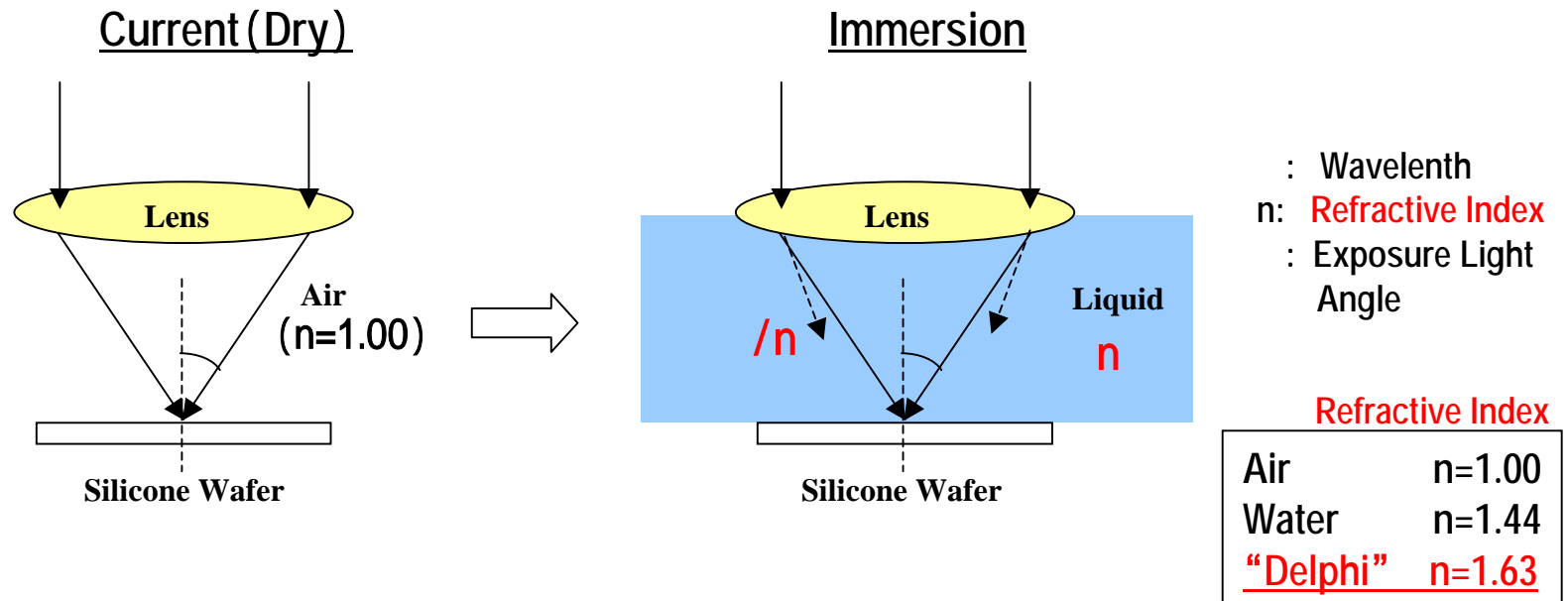
1. Technology that enlarges the aperture of the lens of the lithography machine to achieve higher resolution by replacing air with an immersion fluid with a higher refractive index between the lens and the wafer. This replaces the previously used method of shortening the wavelength of light emitted by an argon-fluoride excimer laser. First-generation development is under way on technology using water with a refractive index of 1.44, raising the prospect of semiconductor fabrication using 45-nm design rules.

2. Imprinting a pattern onto an integrated circuit (IC) chip involves a four-step process: photoresist coating, exposure, developing, and etching. There are two types of photoresists, a photopolymer: one where the exposed areas remain as a pattern and the other where the exposed areas are removed. In the exposure phase, an image of a circuit pattern is transferred onto the wafer using a photolithography machine that emits a laser or other types of light. A developing solution is then dropped onto the wafer to catalyze a photochemical reaction. Finally, the wafer is sprayed with an etching gas or immersed in an etching solution, which preserves or dissolves the area of the wafer where the photochemical reaction took place, thus creating a circuit pattern.

3. Established in 1996 with equal capital investment from 10 semiconductor manufacturers. At the new Super-Clean Room Facility of AIST (National Institute of Advanced Industrial Science and Technology) in Tsukuba City, Selete conducts R&D activities to develop cutting-edge next-generation semiconductor technology. (<http://www.selete.co.jp>)

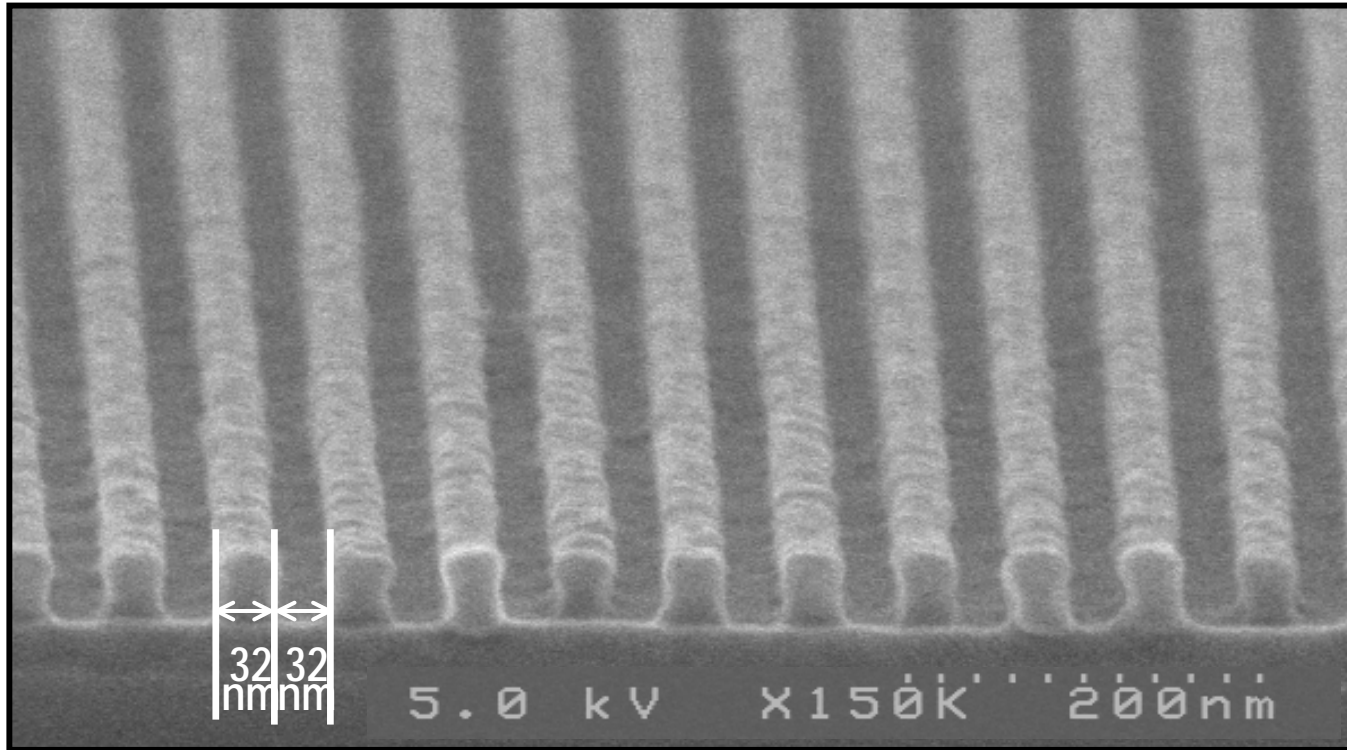
4. A semiconductor memory and a type of random access memory (RAM) which can be used to quickly access and store data. DRAM is the most common kind of memory used in computers due to the relative simplicity of its circuit, stacking ease, and low price.

Immersion Lithography



- Using immersion lithography, the exposure wavelength is shortened by $1/n$.
- The resolution improves by $1/n$ and the focal depth becomes n times.
- Finer design rules and higher yields are possible.

SEM of line and space pattern (32nm)



“Delphi” enables a resolution of 32-nm L/S.