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**Asahi Glass and Tokyo Denpa Succeed in the Development
of a Synthetic Quartz Crystal Material with High Resistance to Laser Light**

Asahi Glass Co., Ltd.

Tokyo Denpa Co., Ltd.

Asahi Glass Co., Ltd. (Headquarters: Tokyo; President: Masahiro Kadomatsu) and Tokyo Denpa Co., Ltd. (Headquarters: Tokyo; Senior Managing Director: Kazunori Hashiguchi) have joined forces to successfully develop a synthetic quartz crystal material with a dramatically improved resistance to laser light as a lens material for the semiconductor exposure lens systems. The co-developed synthetic quartz is a revolutionary material with the rate of deterioration due to light transmission reduced to 1/5 or less of that of the conventional material, which is expected to bring about a cost reduction by lowering the material replacement frequency in semiconductor manufacturing and the improvement of the quality and reliability of semiconductor exposure lens systems.

For exposure lens systems using the excimer laser in semiconductor manufacturing, synthetic quartz crystal with the characteristics of (1) high transmittance, (2) comparatively low price, and (3) ease of processing, as a material of polarizing the optical devices, such as depolarizing plates and wave plates, and diffractive optical devices, including diffractive lenses, have been attracting attention. However, if synthetic quartz crystal, generally manufactured by the hydrothermal synthesis method, is radiated with short wavelength and high power light, such as excimer laser, for an expanded period of time, it is susceptible to the deterioration of optical characteristics, in particular, light transmittance. For this reason, a quartz material with a high resistance to laser light has been called for.

Tokyo Denpa has continued its research and development for providing high quality synthetic quartz crystal ever since it started the production of synthetic quartz crystal in 1977. In 1994, the company succeeded for the first time in the practical application of a platinum autoclave as a high-pressure autoclave for the synthetic quartz crystal production and established the mass production technology for high-quality synthetic quartz crystals with very few crystal defects.

Asahi Glass, on the other hand, has received a high reputation in the market with its leading-edge synthetic quartz glass for the semiconductor device lithography and commercialized SiC, CMP slurry, etc. to accumulate diverse know-how concerning the semiconductor manufacturing equipment.

In the present development, in which Tokyo Denpa took charge of the trial production and production of synthetic quartz crystal and Asahi Glass, of polishing and evaluation, the content of a few impurities included in the synthetic quartz crystal as a cause of deterioration has been reduced to a certain amount. This has resulted in the reduction of the rate of deterioration to 1/5 or less of that of the conventional material.

From now on, Asahi Glass will bring the material to the market for the expected release by the end of fiscal 2007 as a new product of the lithography material.

For further information, please contact:

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<Reference>

- Excimer laser

Excimer laser is a device that generates the laser beam by using a mixed gas of rare gas, halogen, etc. Argon, krypton, or xenon is usually used as a rare gas and fluorine or chlorine as a halogen. Oscillation is produced by the emitted light from the excimer, formed by the excited state rare gas atoms and halogen atoms generated by the electric discharge in the mixed gas.

The table below shows the oscillation wavelength of major excimer lasers.

Type of laser	Oscillation wavelength
ArF (argon fluoride)	193 nm
KrF (krypton fluoride)	248 nm
XeCl (xenon chloride)	308 nm
XeF (xenon fluoride)	353 nm

(Note) nm = nanometer (nano- = one-billionth)

- Depolarizing plate

An element for converting a polarized beam into a depolarized beam; used before/after an instrument that is not affected by the polarization properties.

- Wave plate

A double refraction element that introduces a phase difference ($\lambda/4$ or $\lambda/2$) between the orthogonal polarization components.

- Diffractive lens

A lens that uses the diffraction phenomenon of light to condense or diffuse light.

- Hydrothermal synthesis method

A fragment of the natural quartz crystal (lasca) as the raw material is placed in the lower area and the seed crystal is hung in the upper area of the high temperature high pressure container which is called an autoclave, which is then filled with the alkaline solution, sealed, and kept under high-temperature and high-pressure conditions (approximately 350 degrees C, 90-145 MPa). The raw material (lasca) in the lower area of the autoclave dissolves under the high-temperature and high-pressure environment, and becomes saturated. Maintaining a temperature in the upper area lower than that of the lower area generates heat convection inside and the saturated solution is brought up to the upper area with a lower temperature. The upper

area becomes supersaturated, which causes the quartz to recrystallize and grow on the surface of the seed crystal.