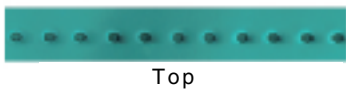
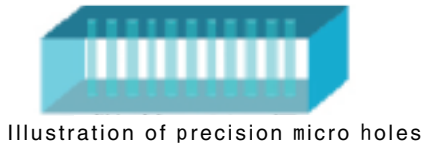


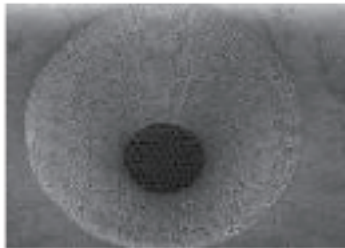
## Femtosecond Laser

Femtosecond laser processing has great advantages in precise micro-machining to the transparency materials such as silica glass, sapphire, and diamond. Our processing technologies may provide the precise micro-holes and binary lens processing. The femtosecond laser has an ultra short pulse width of 100 fs (1fs=10<sup>-15</sup>) compared to that of the conventional YAG laser of several tens of ns (1ns=10<sup>-9</sup>). A wavelength of the femtosecond laser is near infrared light of 800nm which is transparent to materials such as a sapphire and a silica glass. However focused femtosecond laser can induce refractive index modification inside the materials or ablate materials on the surface only around the focal point. By using these features, three-dimensional micro structures and micro optics can be generated on and inside the materials.

### < Precision micro holes in a silica glass plate >

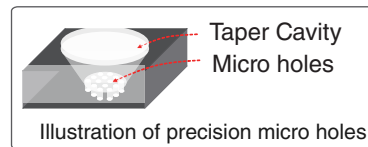


▲ Dia.: 25 μm, thickness: 500 μm, silica glass



- Specifications
  - Min. diameter:  $\geq 0.5 \mu\text{m}$
  - Max. aspect ratio:  $\leq 20$
  - Circularity:  $\leq 1 \mu\text{m}$
- Features
  - High aspect ratio
  - Small surface roughness ( $R_a \leq 10\text{nm}$ )
- Applications
  - Micro nozzle
  - Micro fluidics

### ◀ Three-dimensional hole in a sapphire wafer



- Features
  - Min. line width:  $\sim 2.5 \mu\text{m}$
  - Max. diffraction efficiency:  $\sim 40\%$
- Applications
  - Optical sensor window
  - Micro lens
- Applicable materials
  - Silica glass, pyrex
  - Sapphire, diamond
  - Single crystals, various other glasses

### < Binary lens processing >



▲ Dia.: 1.0mm φ, silica glass

