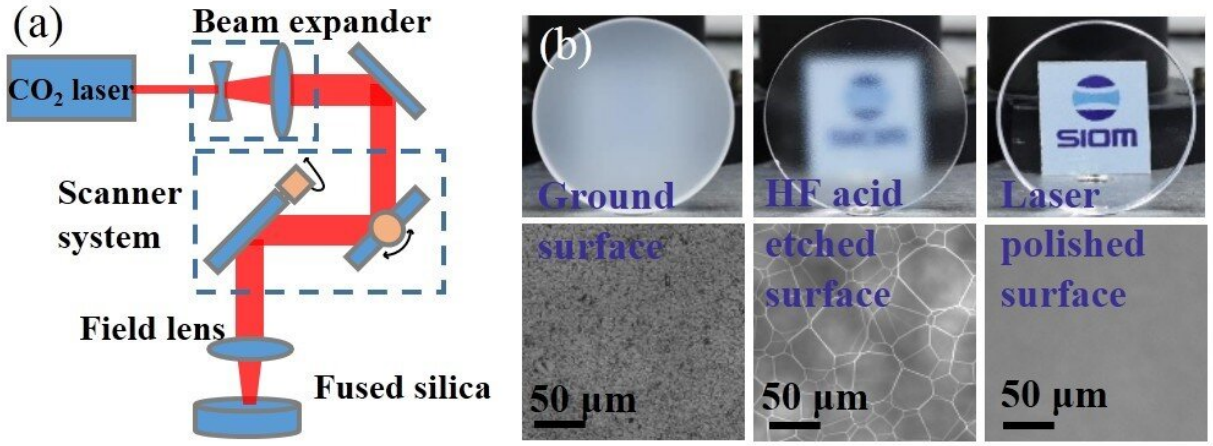
Researchers achieve fused silica with high damage threshold by combing chemical etching and laser polishing

November 2 2020, by Zhang Nannan



(a) Schematic of a laser polishing system. (b) Surface morphology evolution during the combined process. Credit: SIOM

Laser damage in fused silica, particularly ultraviolet laser damage, is still a key problem limiting the development of high-power laser systems. The traditional processing method of fused silica goes through the processes of grinding and chemical mechanical polishing (CMP). This method is time-consuming to achieve an ultra-smooth surface, and is easy to cause surface and sub-surface defects, resulting in a significant reduction in the surface damage threshold of the fused silica.

Recently, a research team from the Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences combined chemical etching and CO_2 laser polishing to process the ground fused silica. Chemical etching was used to open the subsurface defects of the ground fused silica. Subsequently, CO_2 laser polishing was applied to reduce surface roughness.

This combined process not only can efficiently obtain a super-smooth surface with a low surface roughness, but also can improve the damage resistance of fused silica. This work was published in the *Optics Letters*.

Through damage morphology and a defect analysis, the combined process was shown to avoid the introduction of surface and subsurface defects, including destructive defects, chemical-structure defects, and photoactive mental impurity elements, and obtain fused silica with lower surface defect density, thereby obtaining better damage resistance.

More information: Zhen Cao et al. Ground fused silica processed by combined chemical etching and CO2 laser polishing with super-smooth surface and high damage resistance, *Optics Letters* (2020). DOI: 10.1364/OL.409857

Provided by Chinese Academy of Sciences