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Supporting Information

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Rapid Pressureless Sintering of Glasses

*Zhiwei Lin, Xinpeng Zhao, Chengwei Wang, Qi Dong, Ji Qian, Guangran Zhang, Alexandra H. Brozena, Xizheng Wang, Shuaiming He, Weiwei Ping, Gang Chen, Yong Pei, Chaolun Zheng, Bryson Callie Clifford, Min Hong, Yiquan Wu, Bao Yang, Jian Luo, Paul Albertus, and Liangbing Hu**

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Supporting Figures

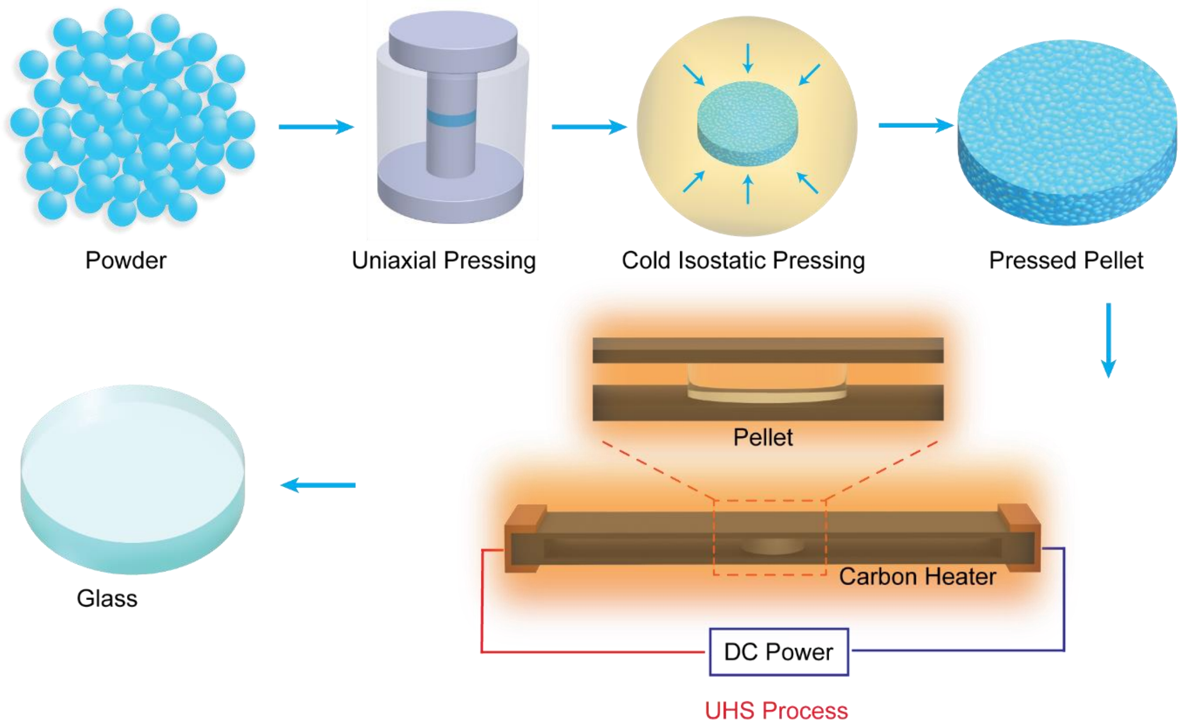

Figure S1. Schematic illustrating the fabrication of transparent glass from silica powders to bulk glasses.

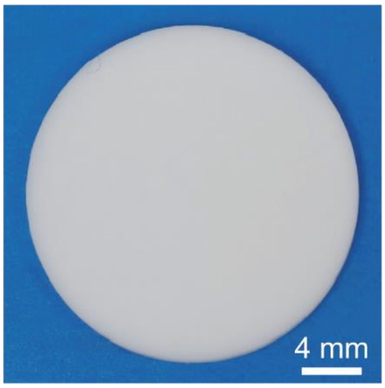

Figure S2. Optical image of the original pellet before the CIP process, showing its white color.

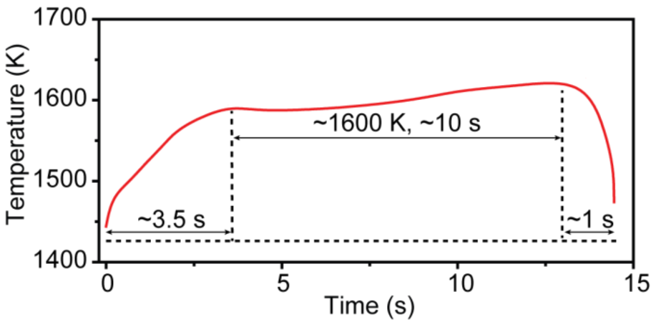

Figure S3. The measured temporal evolution of the applied temperature in a typical UHS process for the sintering of silica glass.

Figure S4. Optical image of the carbon heater during the UHS process at ≈1600 K.

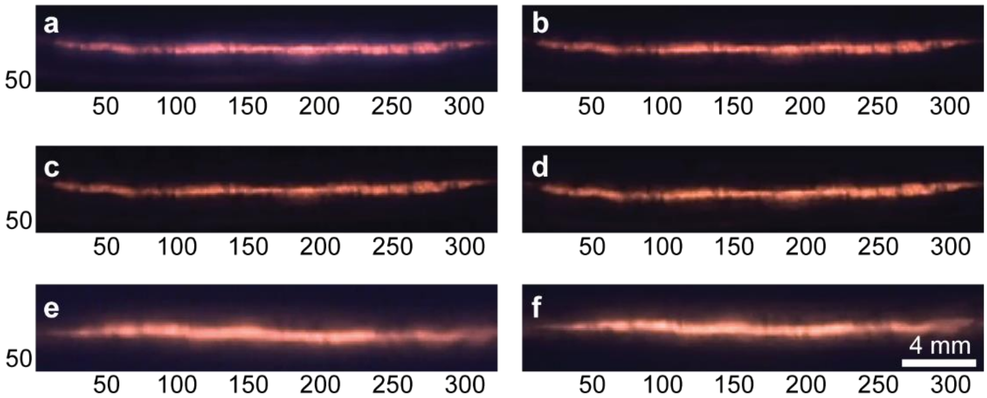

Figure S5. Snapshots of the carbon heater under various powers from the high-speed video, including a) 0.357 kW, b) 0.586 kW, c) 0.876 W, d) 1.198 kW, e) 2.06 kW, and f) 2.95 kW.

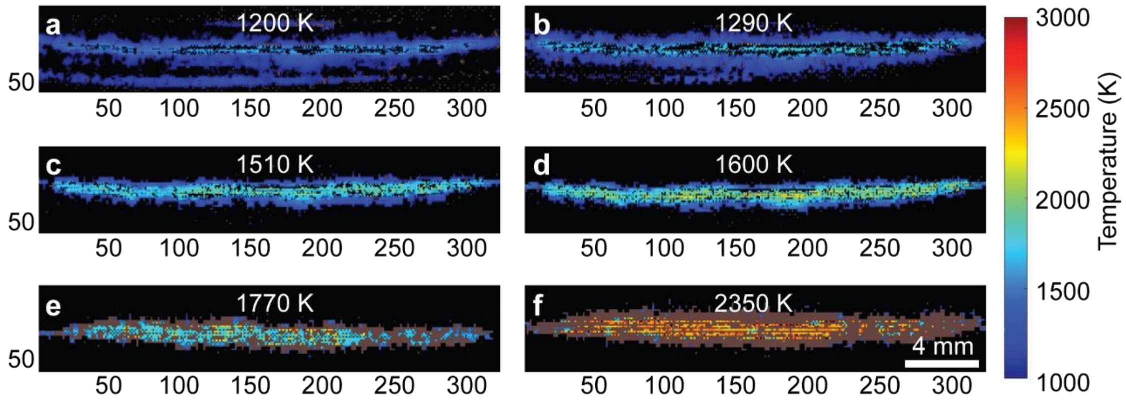

Figure S6. Temperature mapping of the carbon heater under various powers captured with a high-speed camera, including a) 0.357 kW, b) 0.586 kW, c) 0.876 W, d) 1.198 kW, e) 2.06 kW, and f) 2.95 kW.

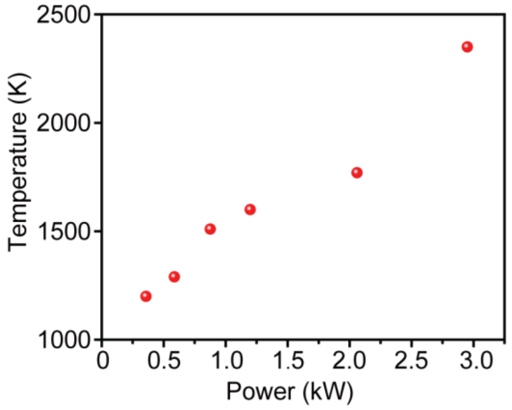

Figure S7. The temperature of the carbon heater increases with the applied power. The sintering temperature can be well controlled by applying various electrical powers, with the temperature ranging from ≈1200 K (at ≈0.357 kW) to ≈2350 K (at ≈2.95 kW).

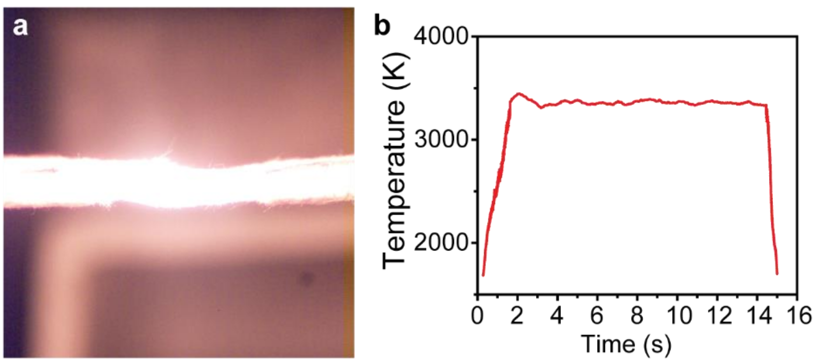

Figure S8. Ultrahigh-temperature (> 3300 K) of the UHS carbon heater. a) Optical image of the UHS carbon heater that shows the ultrahigh temperature of > 3300 K. b) The temperature curves of the UHS carbon heater.

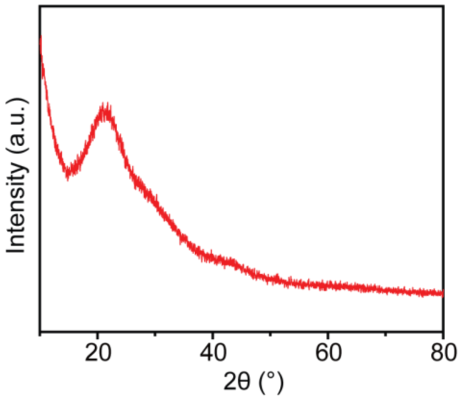

Figure S9. X-ray diffraction pattern of the sintered silica glass demonstrating an amorphous structure.

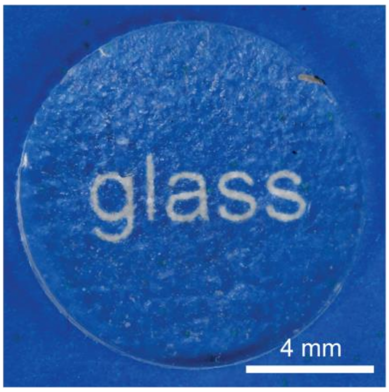

Figure S10. Optical image of the sintered silica before polishing.

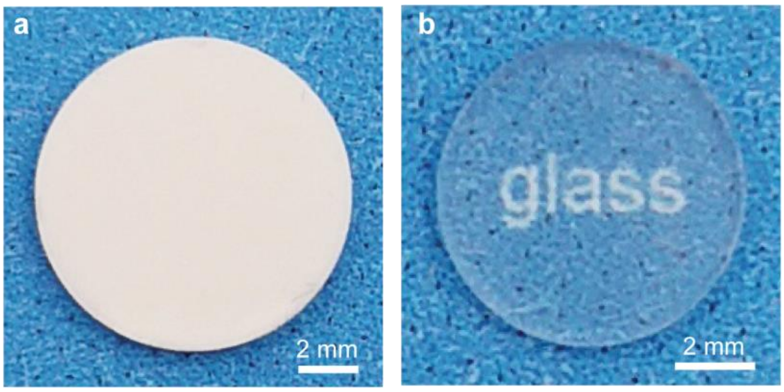

Figure S11. Optical images of the silica pellets a) before and b) after UHS process by sintering micro powder with a size of ≈44 μm.

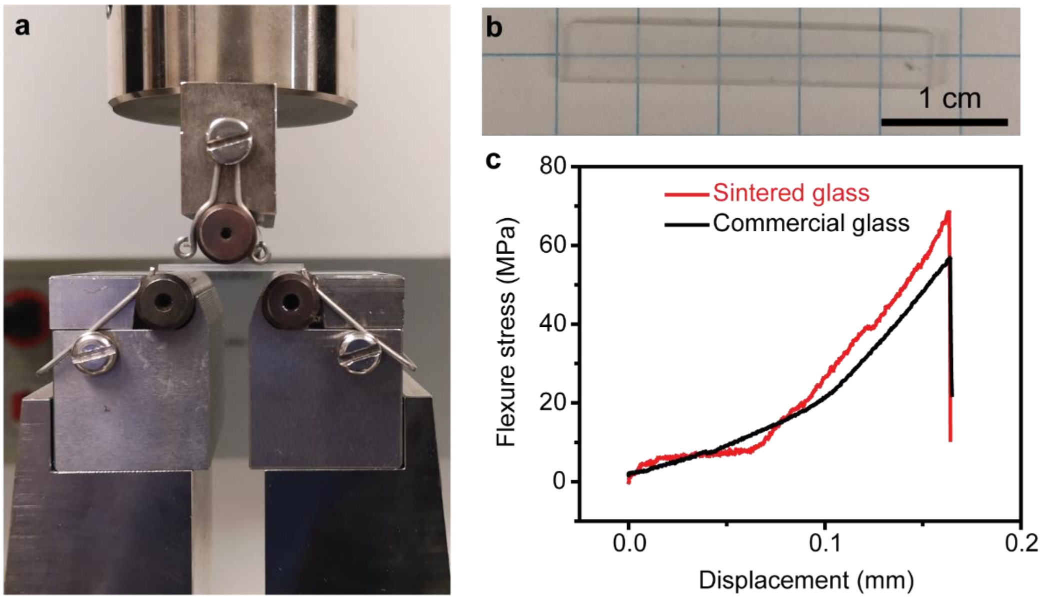

Figure S12. Flexural stress of the UHS-treated glass. a) Experimental setup for testing flexural stress. b) Optical image of the UHS-treated glass with a length of 3 cm. c) Flexural stress of sintered glass compared to commercial glass.

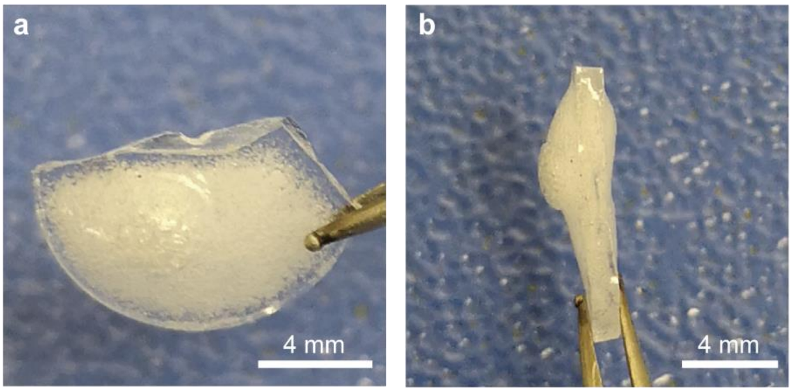

Figure S13. Optical images of the silica glass sintered at ≈1600 K for 100 s from a) front view and b) side view, intuitively indicating volume expansion after sintering for a long time.

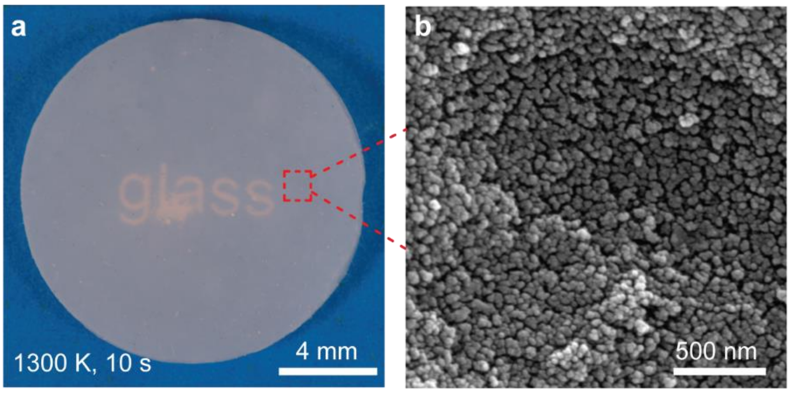

Figure S14. a) Optical and b) cross-sectional SEM image of the silica glass sintered at low temperature (≈1300 K, 10 s).

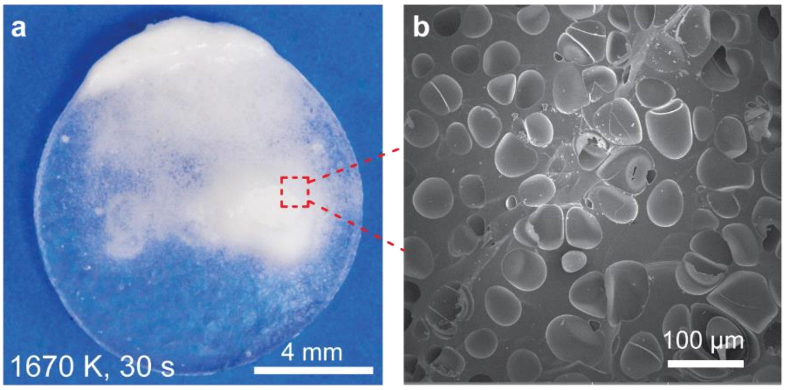

Figure S15. a) Optical and b) cross-sectional SEM image of the silica glass sintered at high temperature (≈1670 K, 30 s).

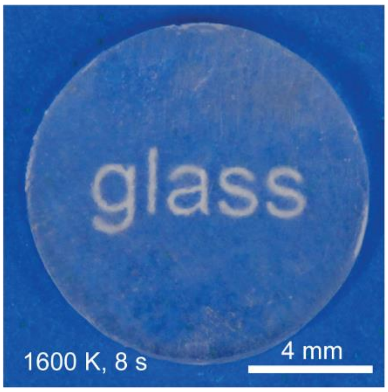

Figure S16. Optical image of the sintered silica glass at ≈1600 K with a sintering holding time of 8 s.

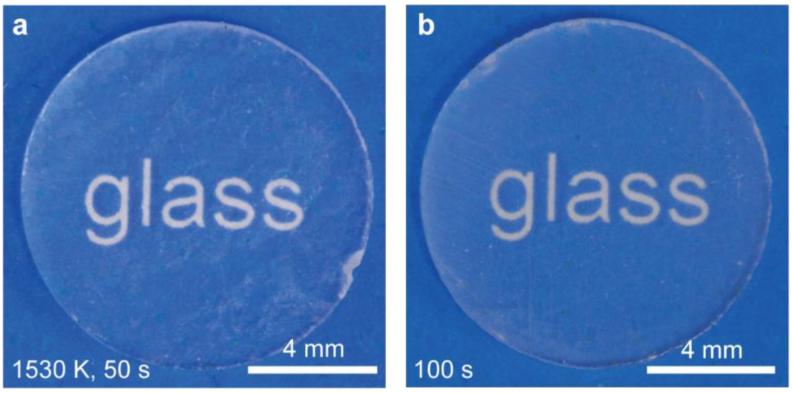

Figure S17. Optical images of the sintered silica glasses at ≈1530 K with sintering holding times of a) 50 s and b) 100 s.

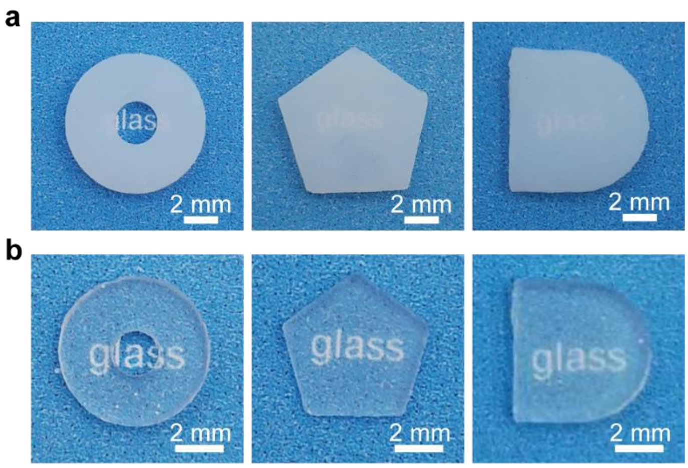

Figure S18. Optical images of glasses with various shapes a) before sintering and b) after sintering by UHS.

Figure S19. Optical image of 1% Gd-doped YAG sintered by UHS.

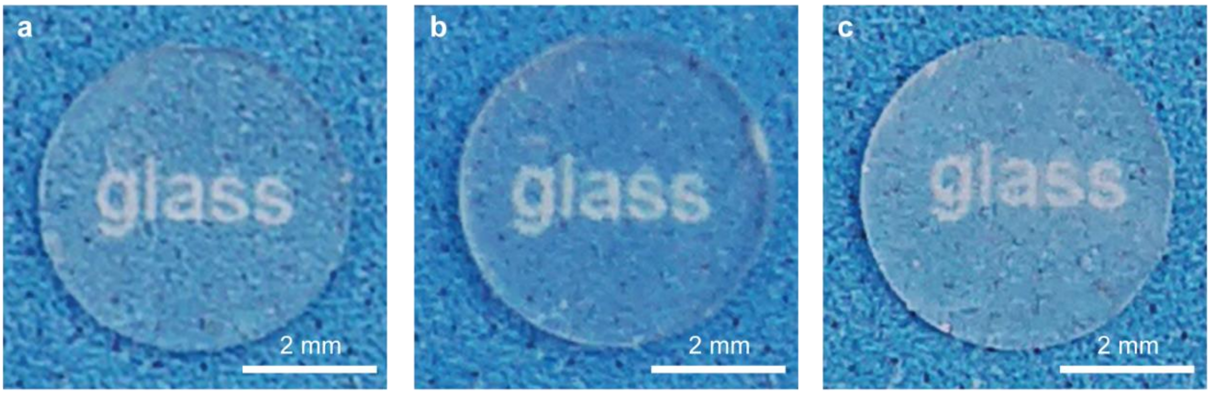

Figure S20. Optical images of silica-based glasses with a) 0.025 wt% ITO, b) 0.025 wt% MgO, and c) 0.025 wt% YAG sintered by UHS.

Table S1. Comparison of the sintered silica glass between our work and other works.

Method	Sintering time (s)	Density (g/cm^3)	Transmittance	Ref.
Gel-casting and sintering	≈10^4	2.32	≈83%	[1]
Furnace sintering	≈2.6×10^4	2.2	≈90%	[2]
Spark plasma sintering	≈3×10^2	—	≈63%	[3]
		≈2.2	≈80%	[4]
Laser sintering	≈10^2	—	—	[5]
Flash sintering	≈30	≈1.9	—	[6]
UHS	≈10	> 2.156	≈90%	This work

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