Electronic Supplementary Material (ESI) for Materials Chemistry Frontiers.

Supporting Information for

Reduction of injection molded silica glass defects and enhancement of glass quality via water debinding

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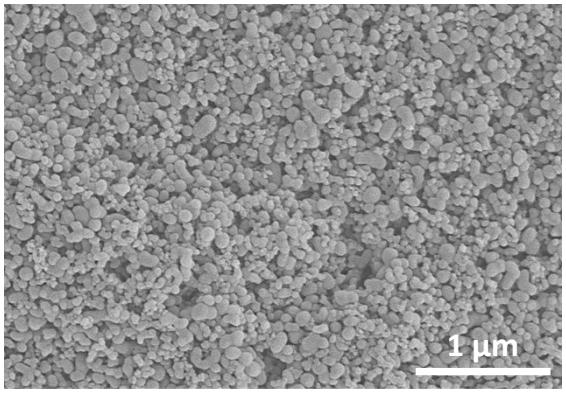

Fig. S1. SEM image of the amorphous silica nanopowders.

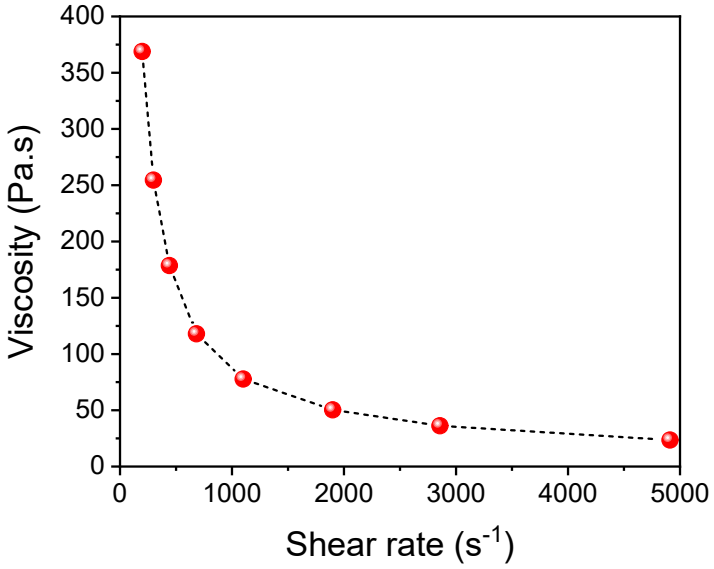

Fig. S2. Viscosity of the silica-plastic nanocomposite measured by a capillary rheometer at 150 °C.

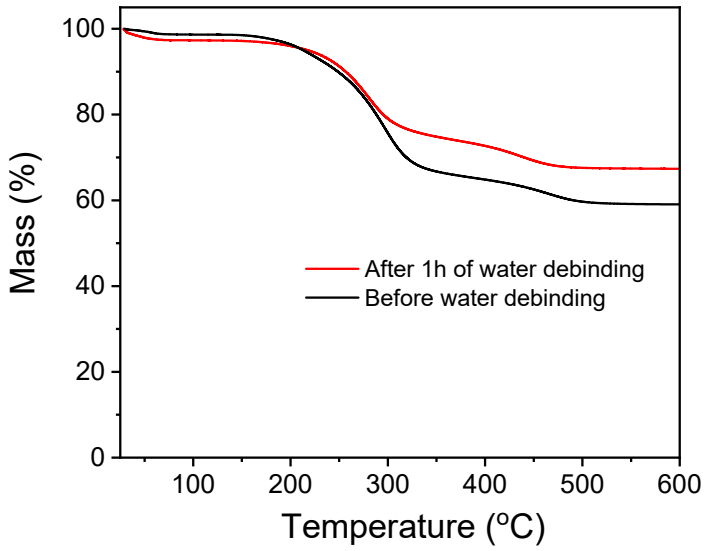

Fig. S3. TGA traces of the green parts before and after water debinding for 1 h.

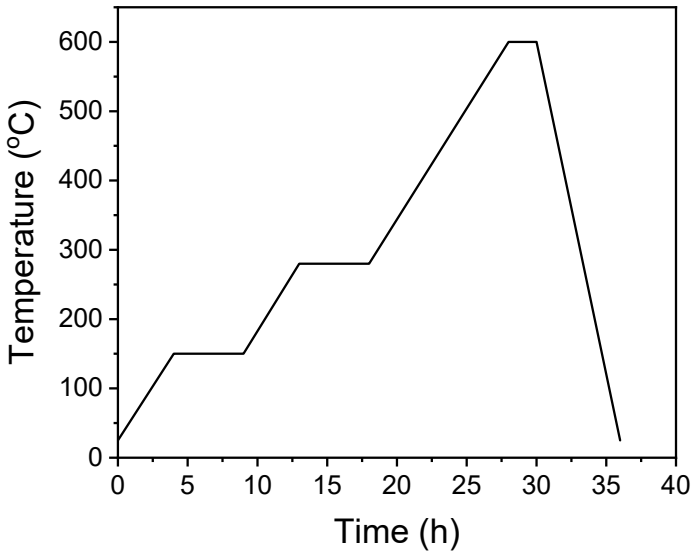

Fig. S4. Temperature protocol for thermal debinding of the green parts.

Fig. S5. Photograph for the brown parts, demonstrating the presence of large cracks after thermal debinding. The green parts were thermally debound directly without water debinding.

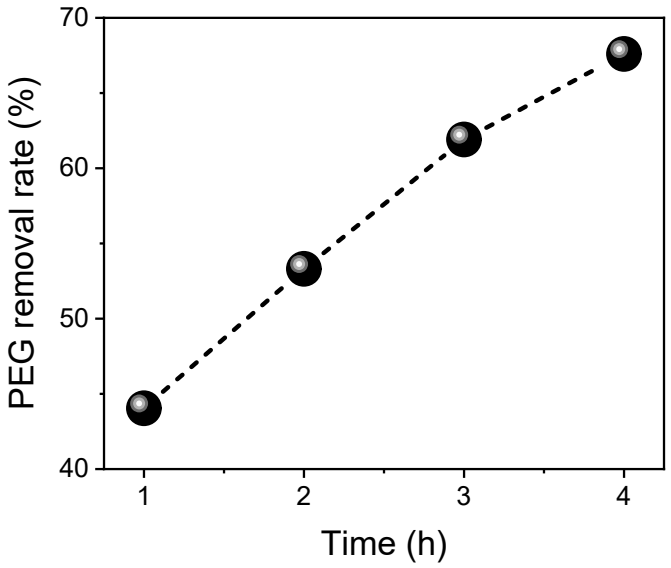

Fig. S6. PEG removal rate from the green parts during water debinding at room temperature.

Fig. S7. Photograph for the brown parts, indicating the presence of cracks after thermal debinding. The green parts were processed by water debinding for 1 h then by thermal debinding.

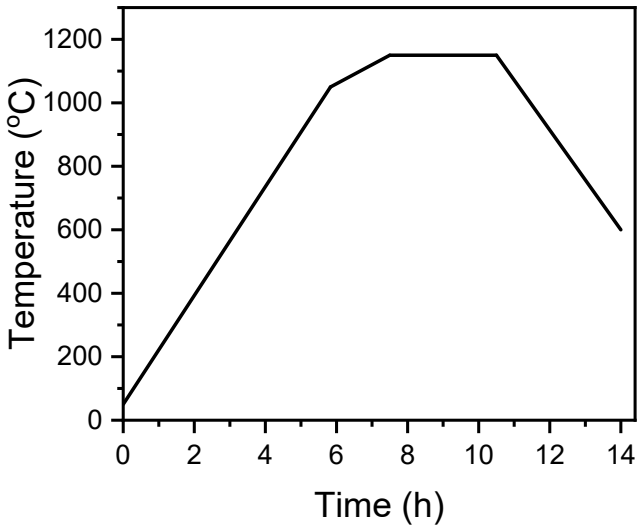

Fig. S8. Temperature protocol for the sintering process of the brown parts.

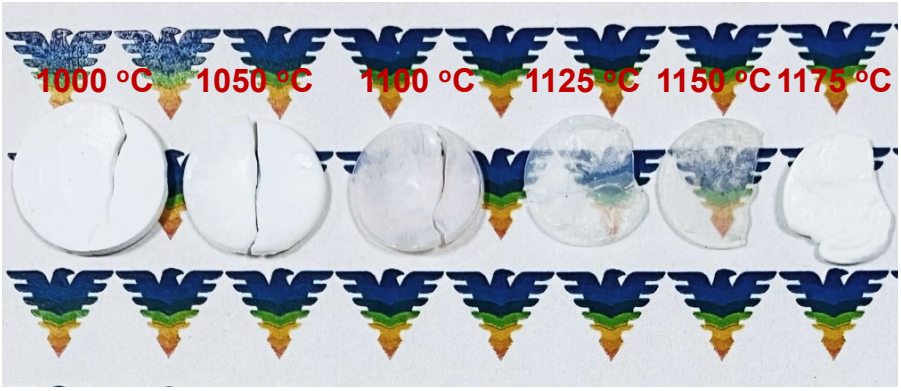

Fig. S9. Photograph for the heat-treated brown parts at different temperatures for 3 h. The green parts of these samples were thermally debound without water debinding.

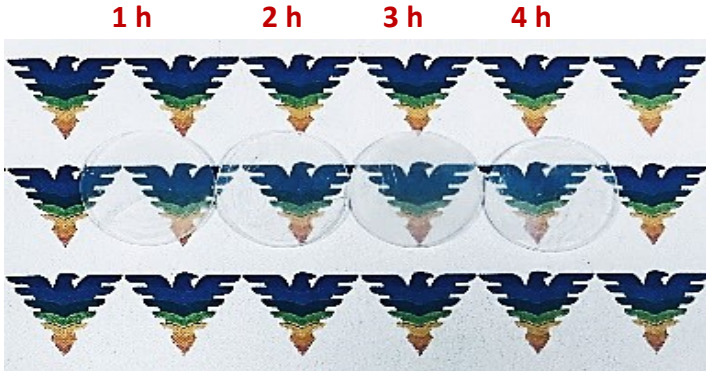

Fig. S10. Photograph for the densified silica glass samples that were sintered at 1150 °C for 3 h. The green parts of these samples were water debound at different time starting from 1 h to 4 h.

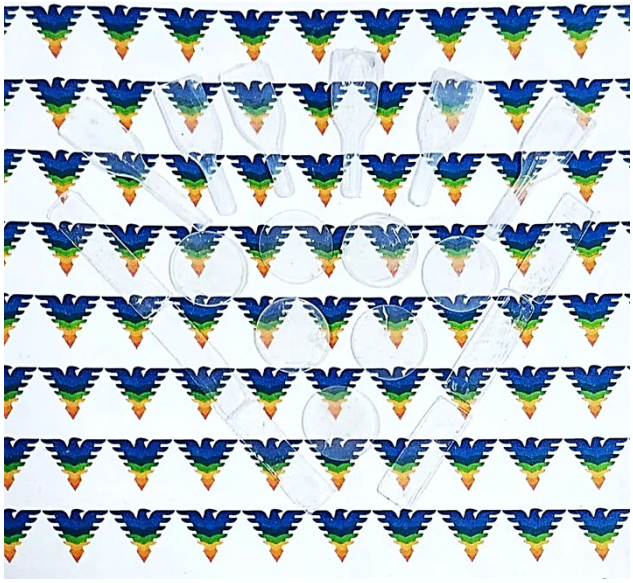

Fig. S11. Photograph of about 19 pieces of the as-prepared silica glass samples fabricated by the injection molding technique. The total molding time for the green parts is about 2 min with cycle time of 6 s per piece, indicating that the high-throughput fabrication of silica glass with different shapes was achieved.

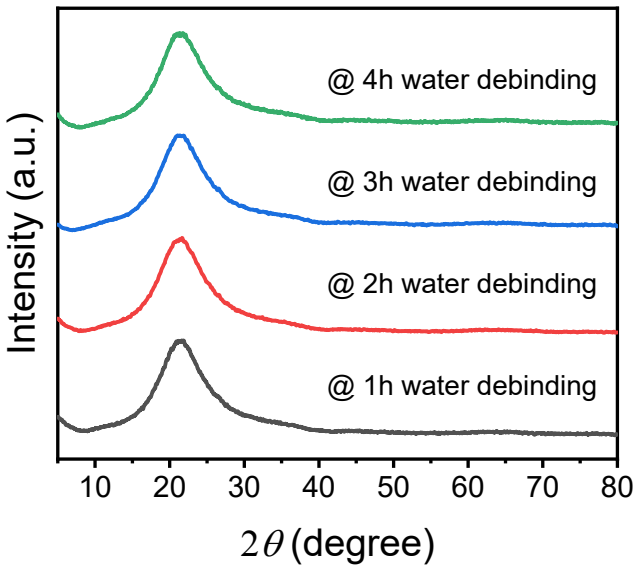

Fig. 12. XRD patterns of the as-prepared silica glass with water debinding for different durations, followed by sintering at 1150 °C for 3h.

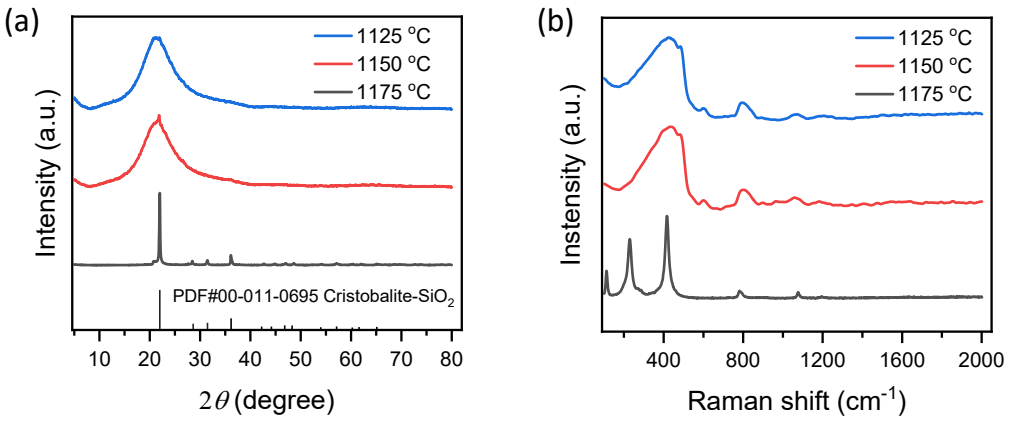

Fig. 13. (a) XRD patterns and (b) Raman spectra of the as-prepared silica glass obtained by sintering at different temperatures for 3h without water debinding.

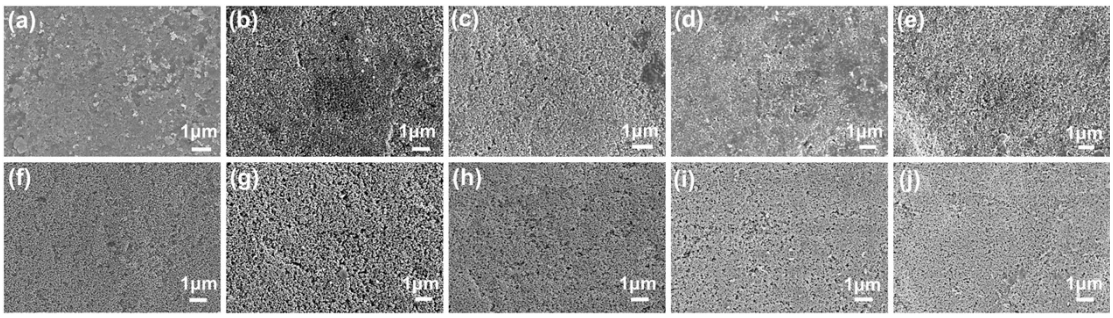

Fig. 14. SEM images of the as-prepared (a-e) green parts and their corresponding (f-j) brown parts at water debinding durations of (a,f) 0 h, (b,g) 1 h, (c,h) 2 h, (d,i) 3 h, and (e,j) 4 h.

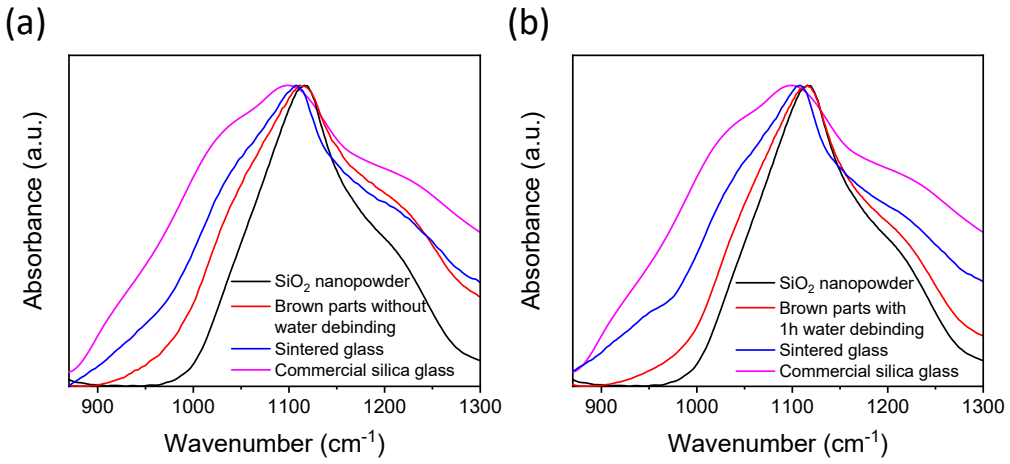

Fig. 15. FTIR spectra of the as-prepared brown parts and sintered glass (a) without water debinding and (b) with 1h water debinding. The FTIR spectra of the silica nanopowder and commercial fused silica glass were plotted for comparison.

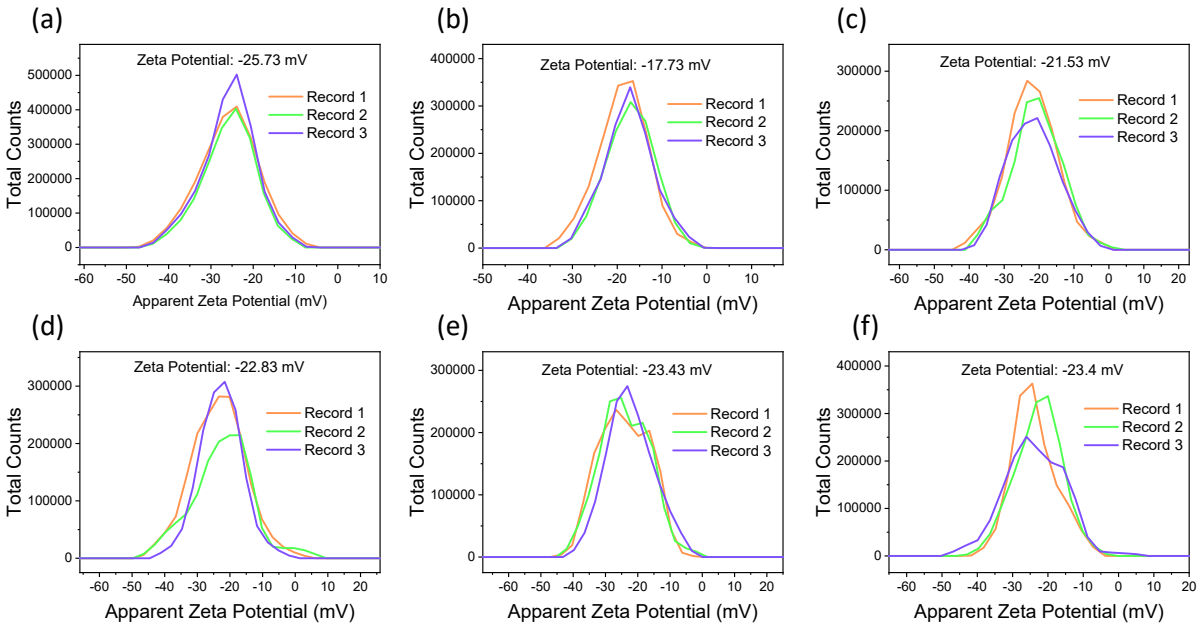

Fig. 16. Zeta potential curves for the (a) silica nanopowder and brown parts at different water debinding durations of (b) 0 h, (c) 1 h, (d) 2 h, (e) 3 h, and (f) 4 h.