Supplementary Information

Manufacturing and Thermal Shock Characterization of Porous Yttria Stabilized Zirconia for Hydrogen Energy Systems

M Faisal Riyad, Mohammadreza Mahmoudi, and Majid Minary Jolandan*

Mechanical and Aerospace Engineering, School for Engineering of Matter, Transport and Energy, Arizona State University, Tempe, AZ 85287, USA

*Corresponding author email: majid.minary@asu.edu

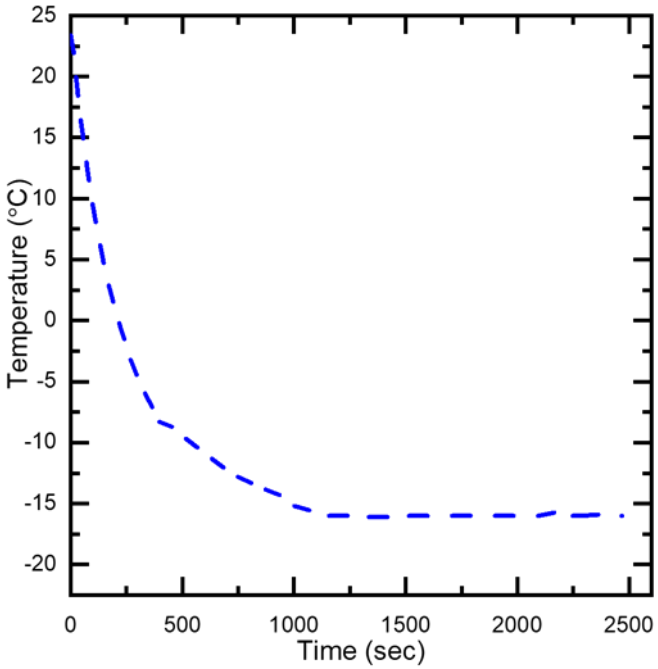

Figure S1. The temperature profile of the thermoelectric plate during freeze casting of YSZ slurry.

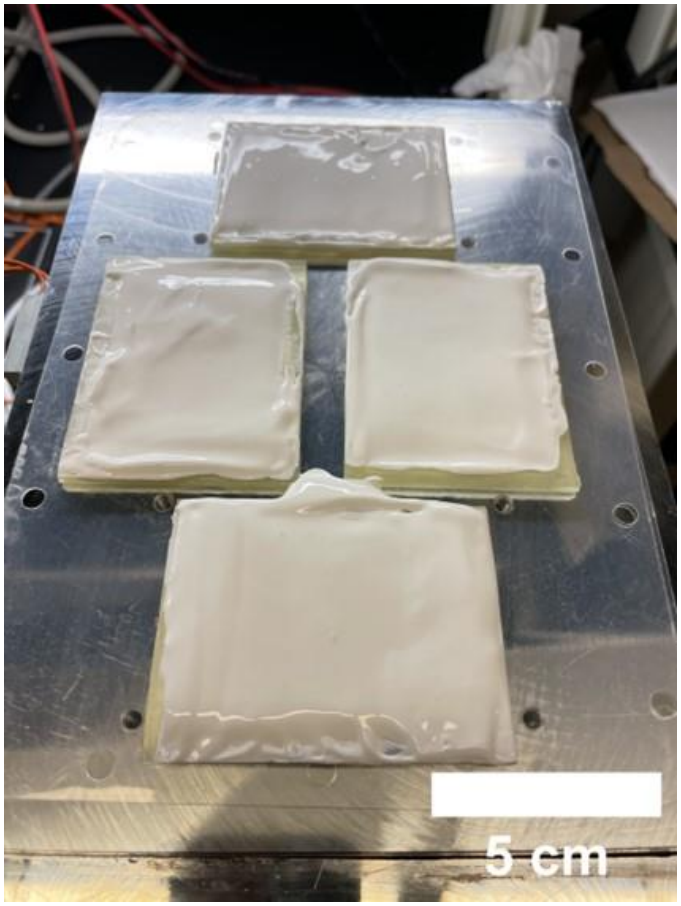

Figure S2. Freeze casting of YSZ slurry into molds on the surface of the thermoelectric cold plate.

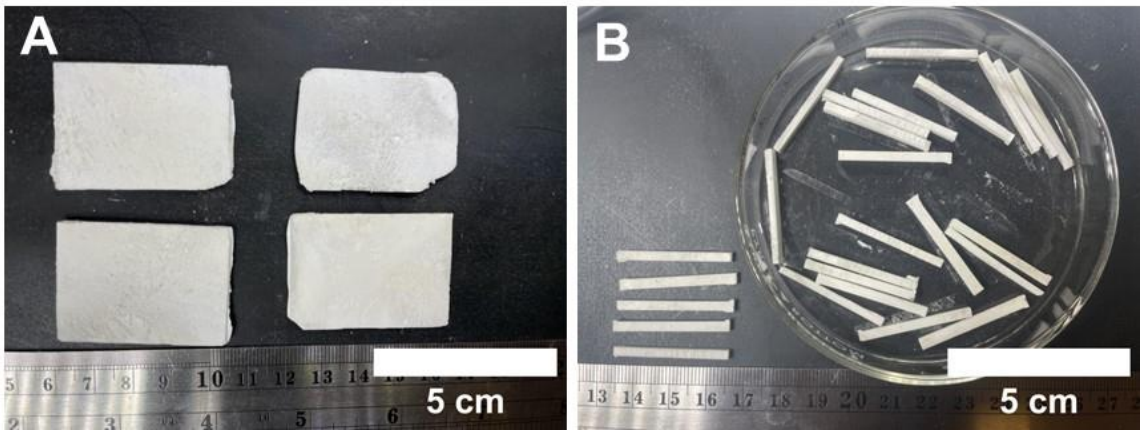

Figure S3. (A) Images of representative sintered YSZ sheets after polishing. **(B)** YSZ beams prepared from polished YSZ sheets for flexural test.

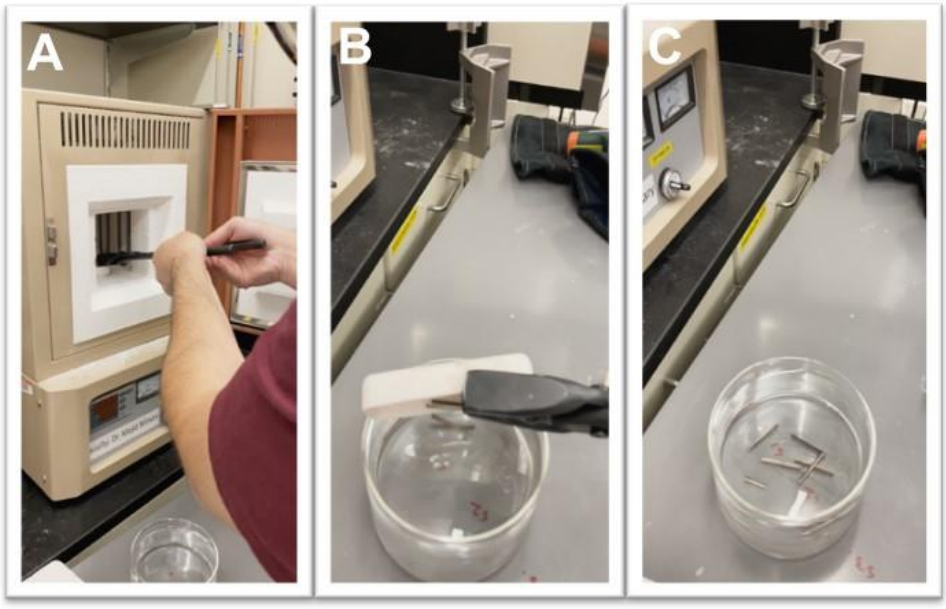

Figure S4. Thermal shock test. **(A)** Taking the beams from the furnace after thermal equilibrium at a desired temperature. **(B)** Quenching the heated beams in DI water. **(C)** Quenched beams in DI water.

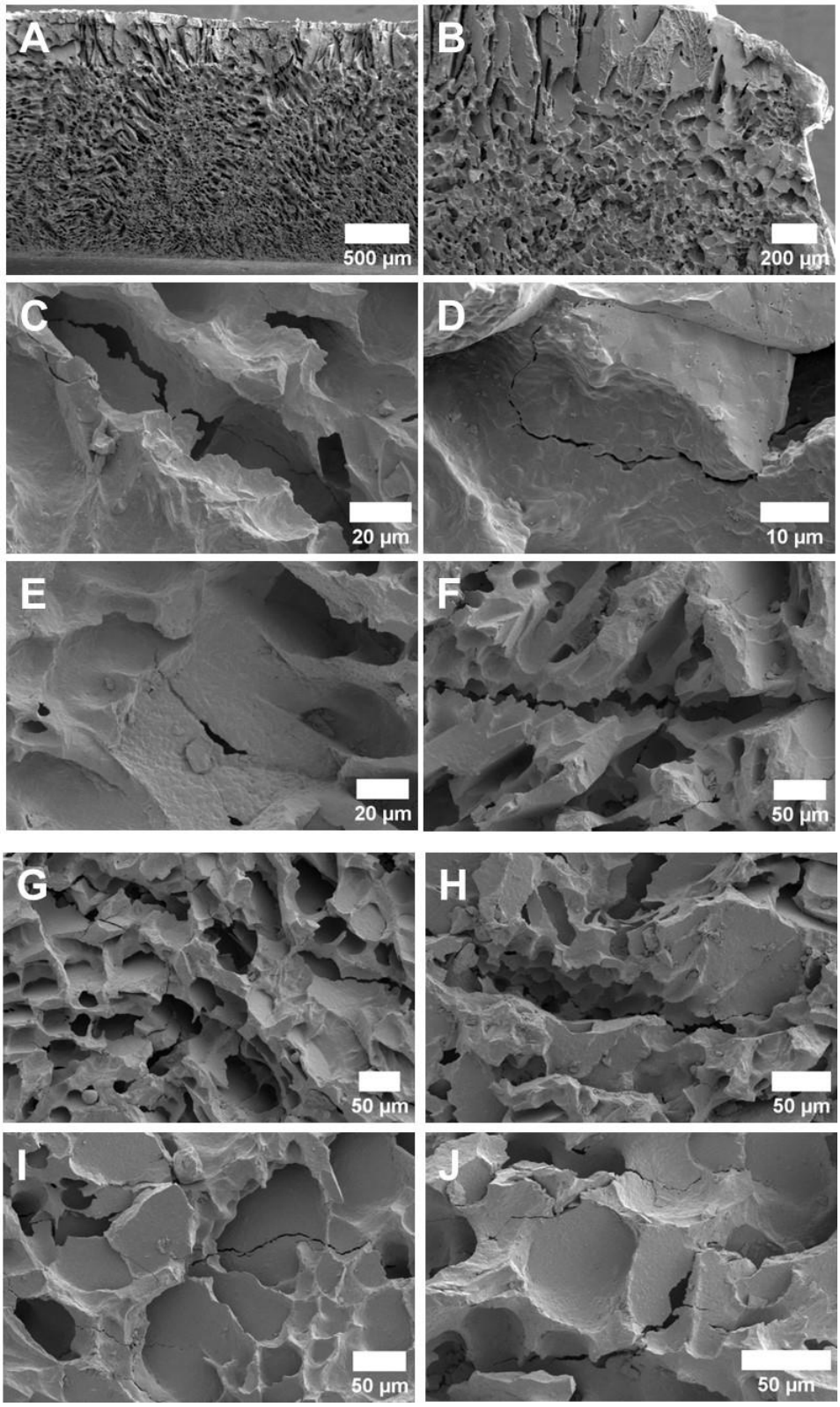

Figure S5. SEM micrograph of the surface of thermally shocked beams tested at temperatures **(A)** and **(B)** 200 °C **(C)** and **(D)** 300 °C **(E)** and **(F)** 400 °C and **(G) - (J)** 500 °C.

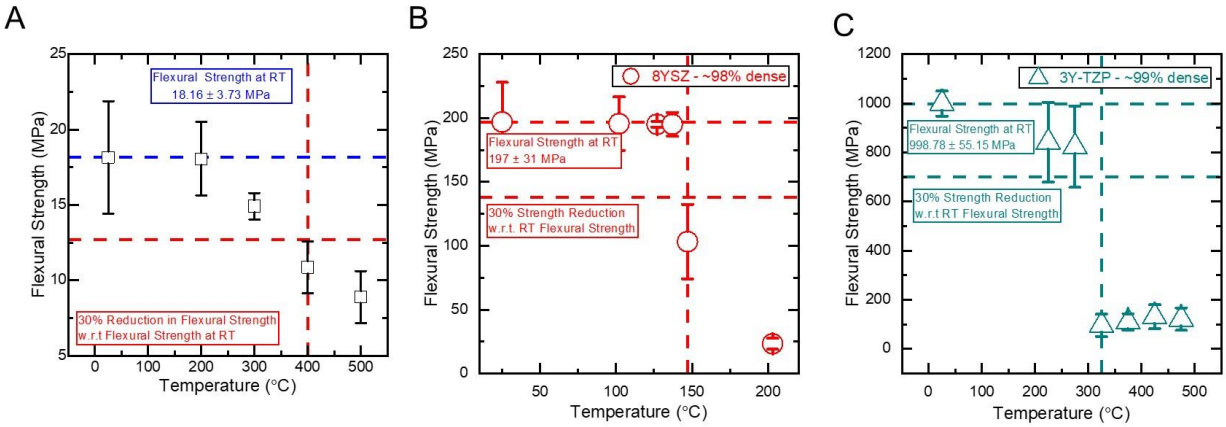

Figure S6. Comparison of flexural strength of (A) porous 8YSZ (this study), (B) dense 8YSZ and (C) 3Y-TZP at different temperatures. B and C are reproduced from [41,42].

References

41. Angle, J.P.; Steppan, J.J.; Thompson, P.M.; Mecartney, M.L. Parameters influencing thermal shock resistance and ionic conductivity of 8 mol% yttria-stabilized zirconia (8YSZ) with dispersed second phases of alumina or mullite. *J. Eur. Ceram. Soc.* **2014**, *34*, 4327–4336.
42. Sato, T.; Ishitsuka, M.; Shimada, M. Thermal shock resistance of ZrO_2 based ceramics. *Mater. Des.* **1988**, *9*, 204–212.