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Shock Ramp of SiO_2 melt

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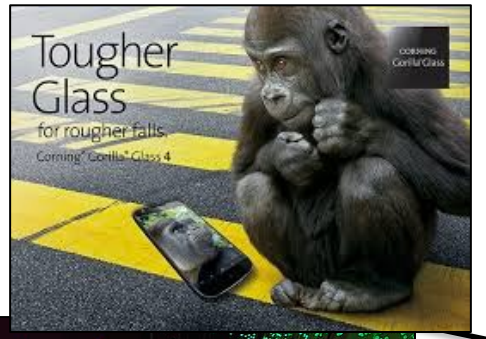
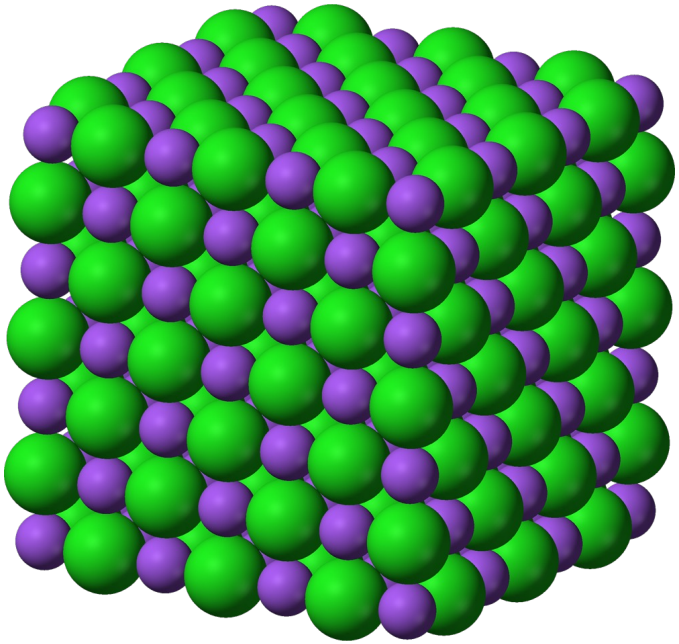
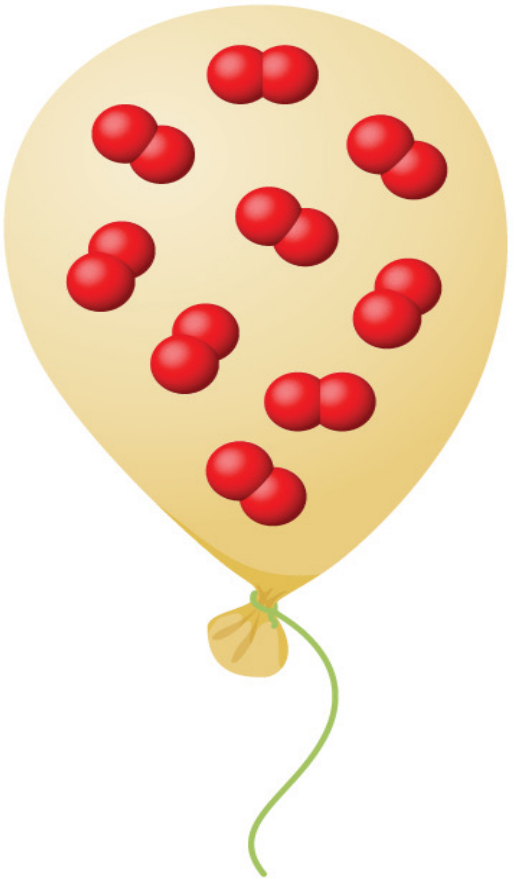
SiO_2 – fundamental to both materials and planetary sciences



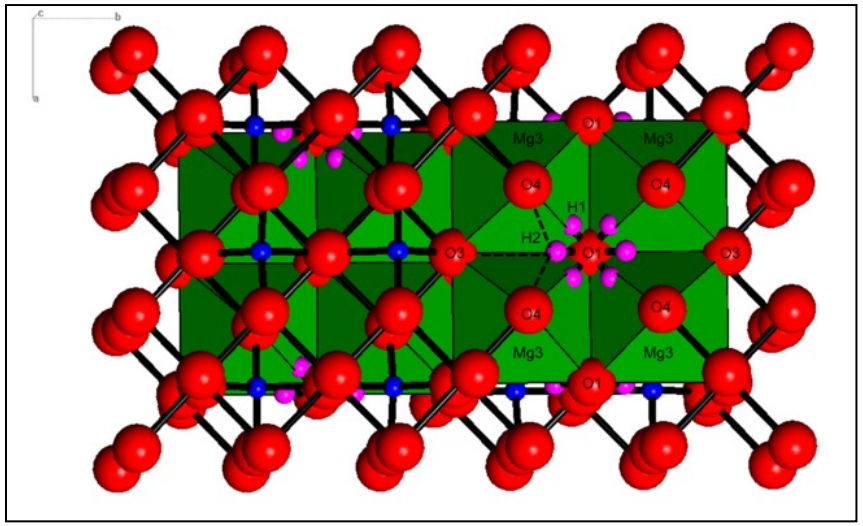
Silicate Melts and Glasses

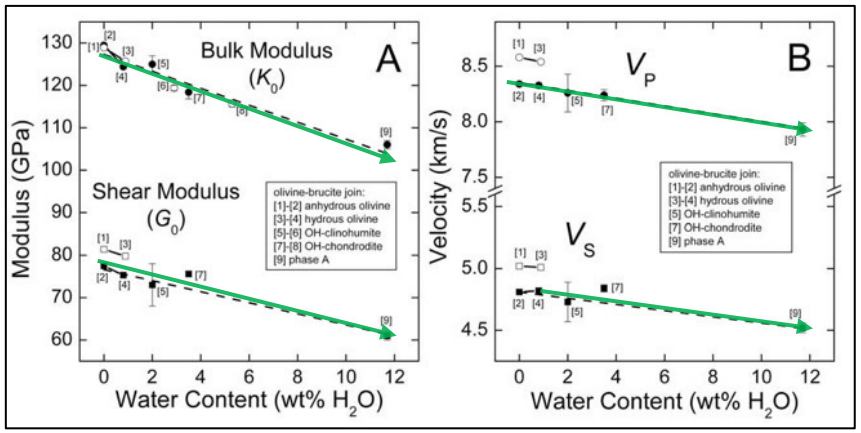
States of Matter



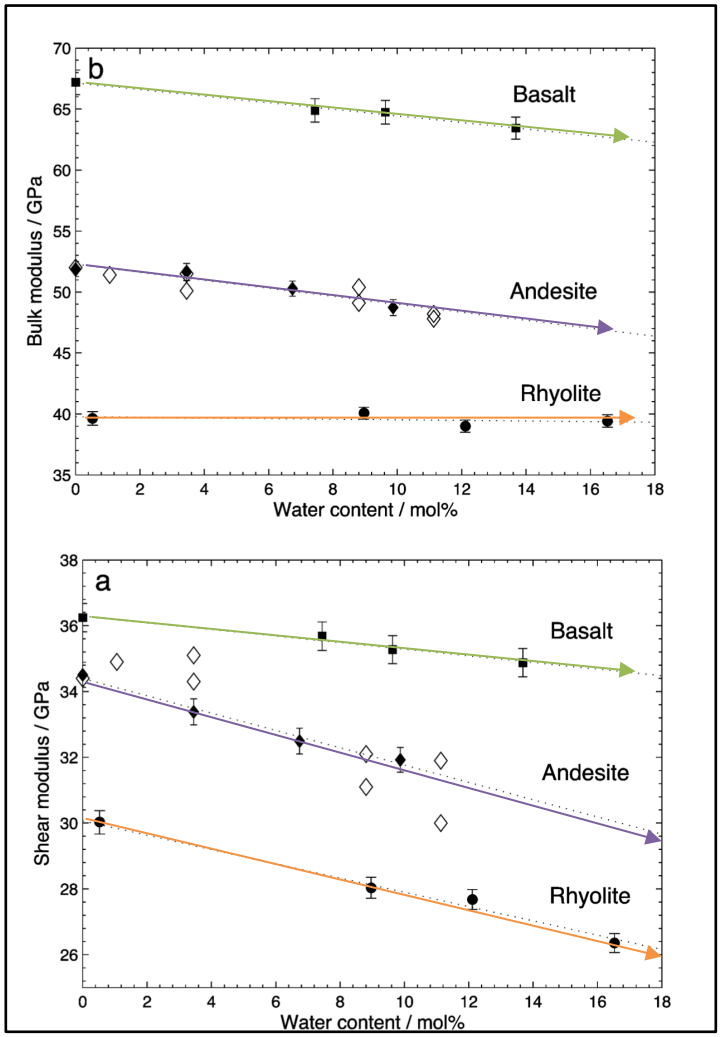


Volatiles soften silicates



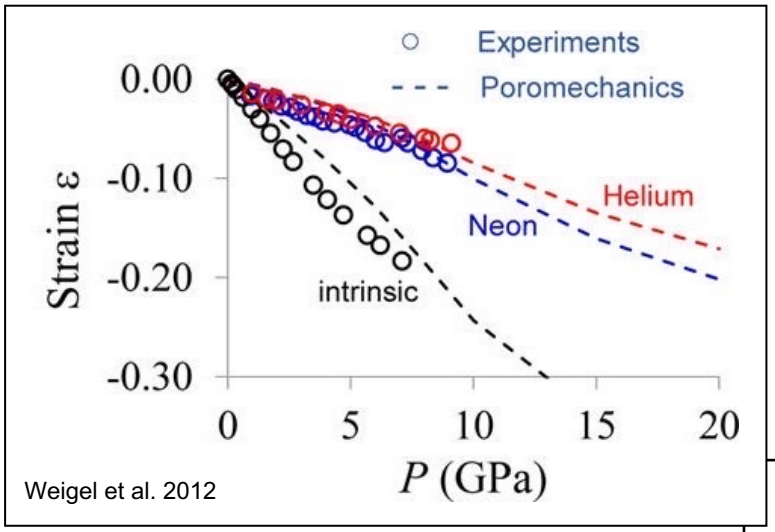


Jacobsen et al. 2008

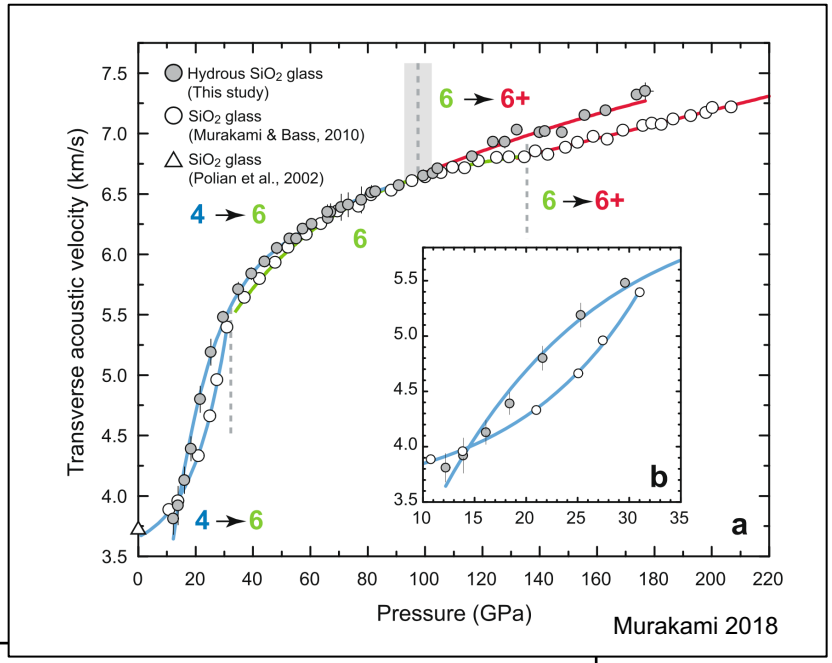


Malfait et al. 2011

Or do they?

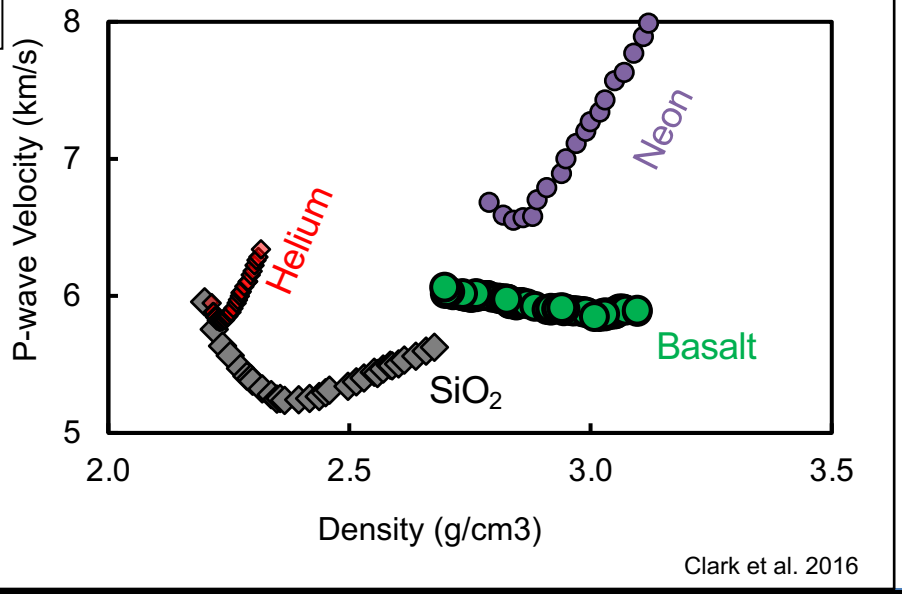


Weigel et al. 2012



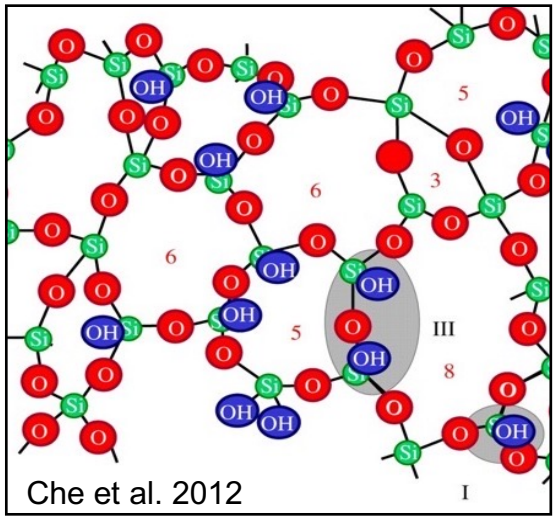
Murakami 2018

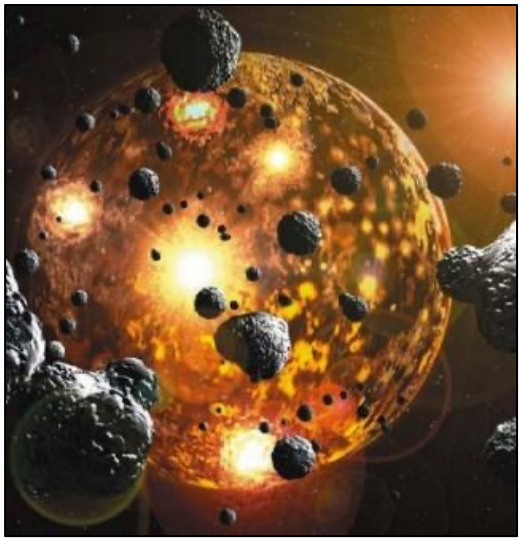
Silicate glasses are *stiffer* when volatiles are present.

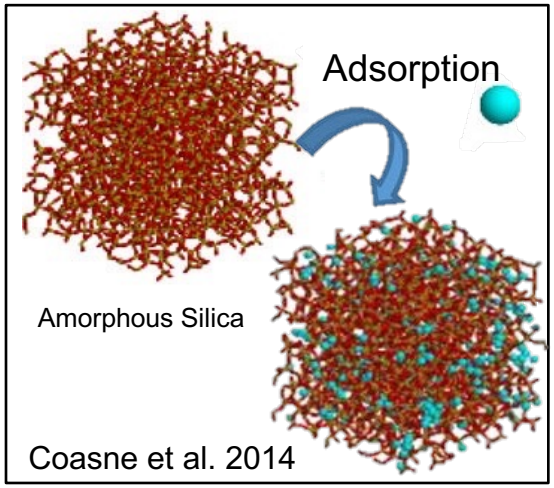


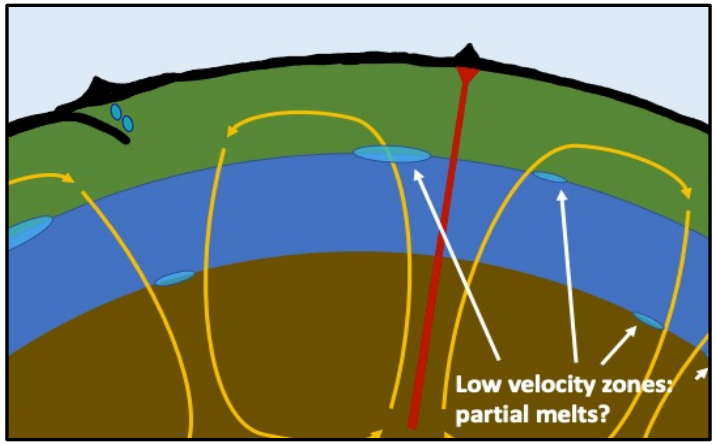
Clark et al. 2016

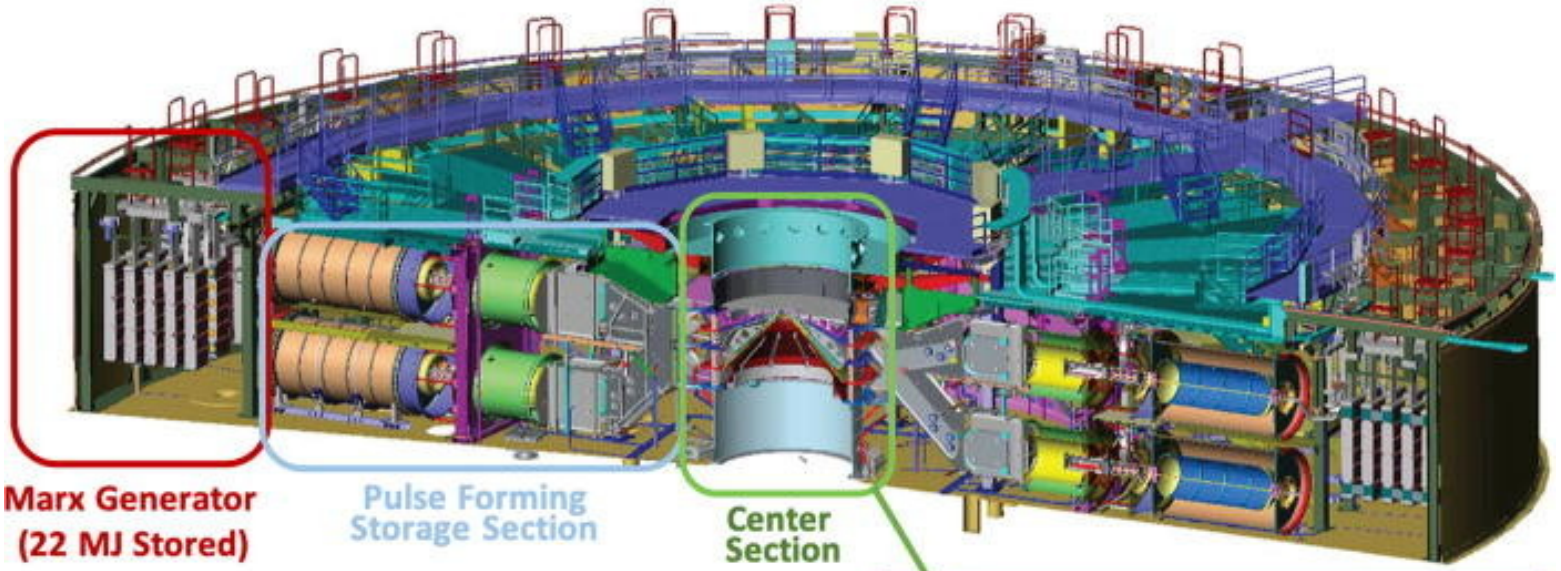
Volatile incorporation into amorphous silicates – How and why do we care?

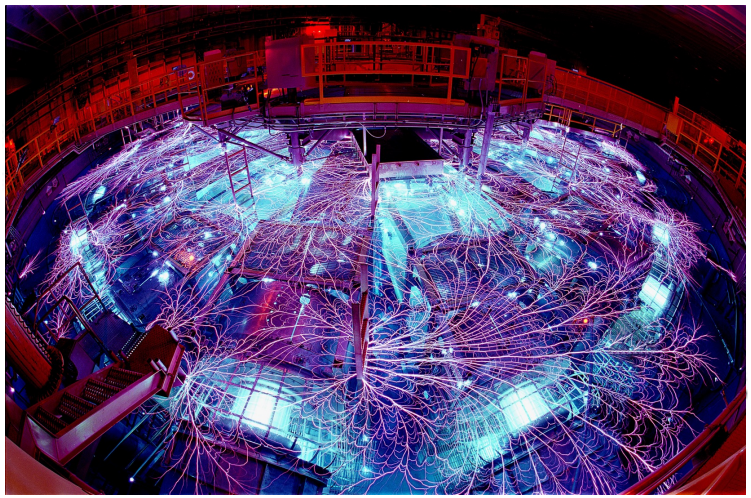












Z-machine at Sandia National Laboratories

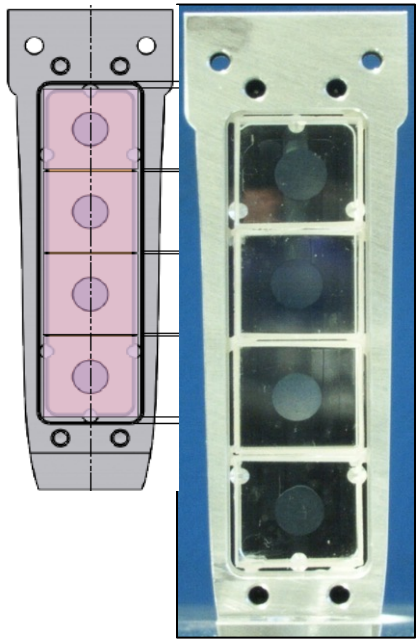
Z-Fundamental Science Project

Origin of Earth's water:Role of hydrous melts at extreme P-T conditions

Sample Materials

CORNING

South Panel



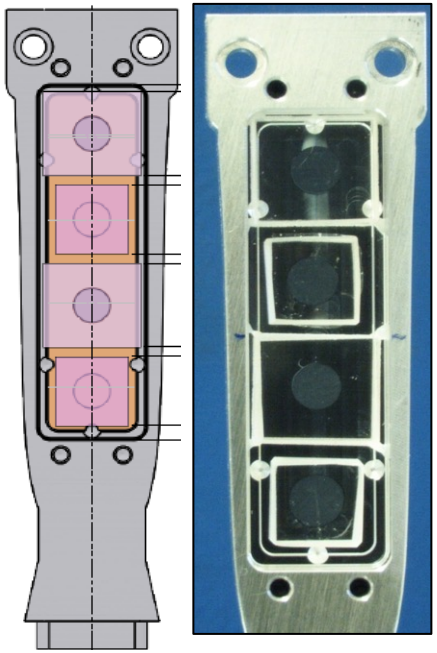
Dry (<1 ppm) SiO_2 – 1.2 mm

Dry (<1 ppm) SiO_2 – 1.0 mm

Damp (1000 ppm) SiO_2 – 1.2 mm

Damp (1000ppm) SiO_2 – 1.0 mm

North Panel



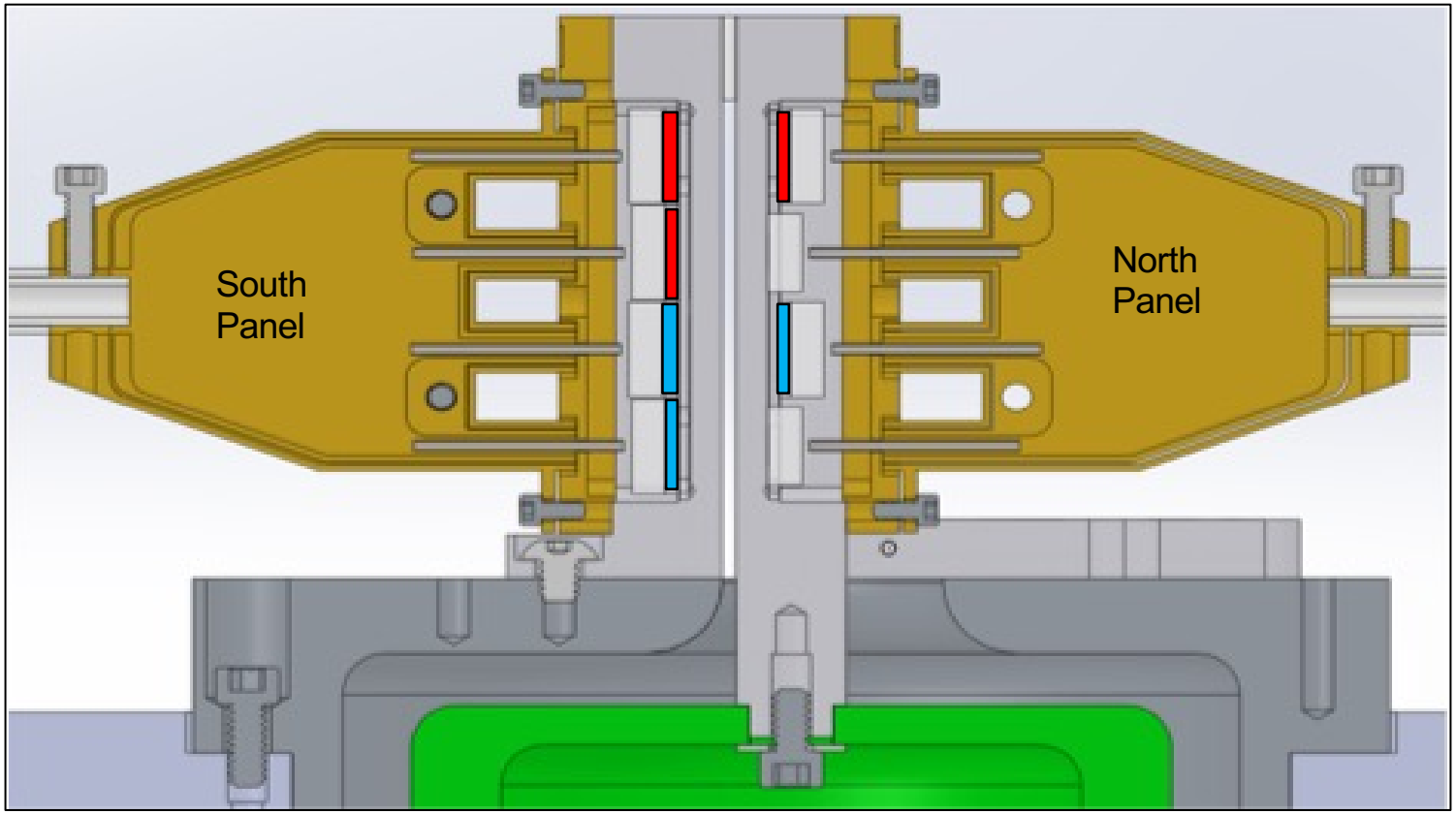
Dry (<1ppm) SiO_2 – 0.8mm

LiF Window Only

Damp (1000 ppm) SiO_2 - 0.8mm

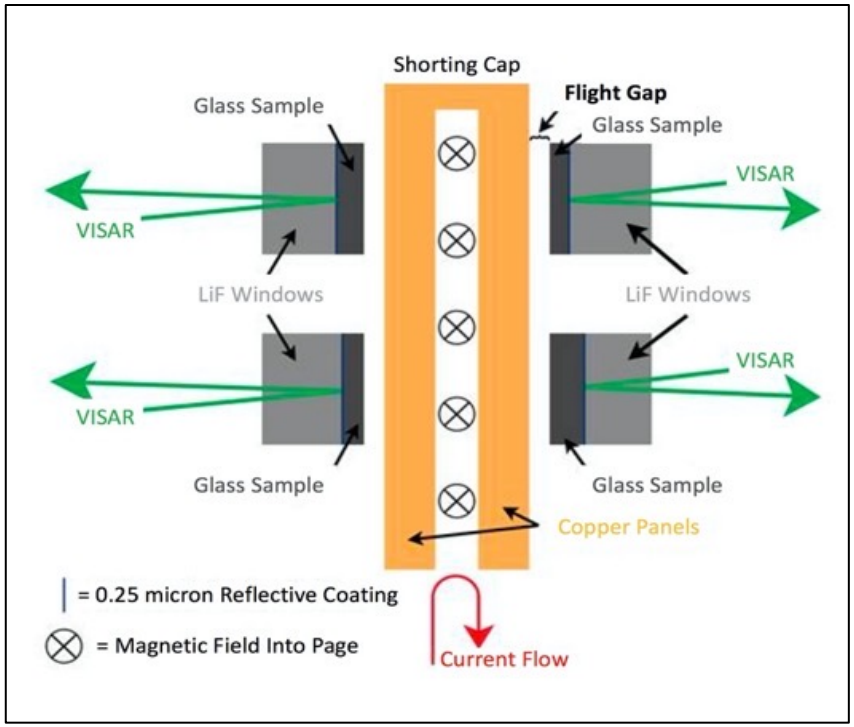
LiF Window Only

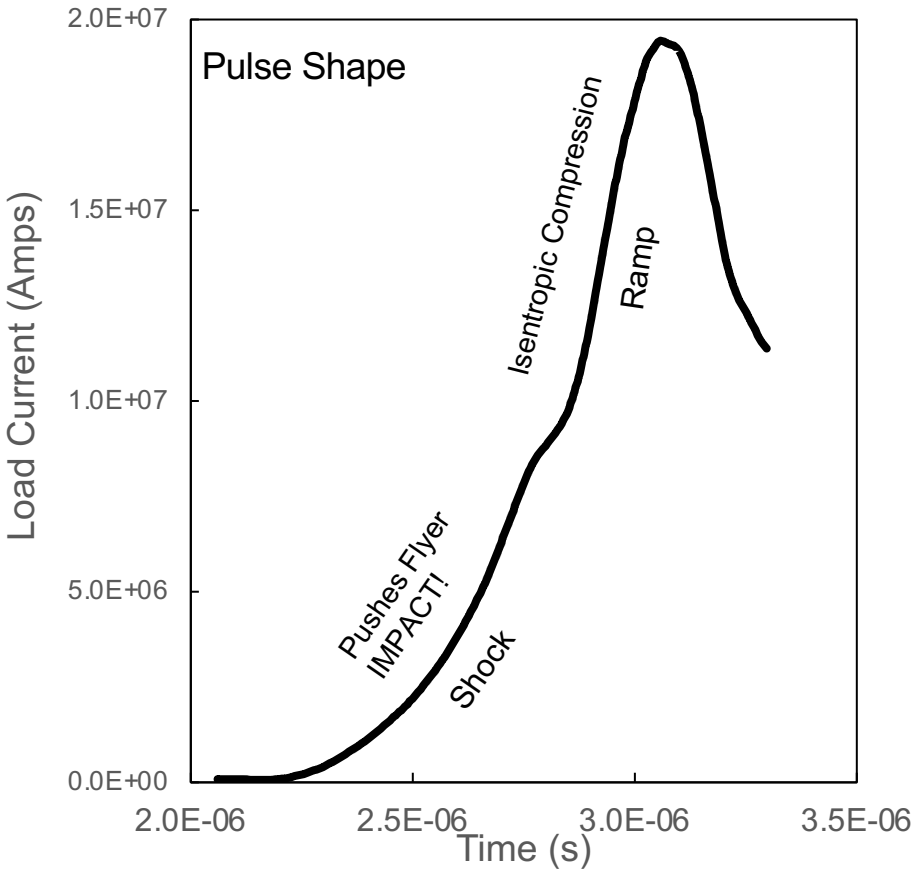
Strip Line Geometry Experiment



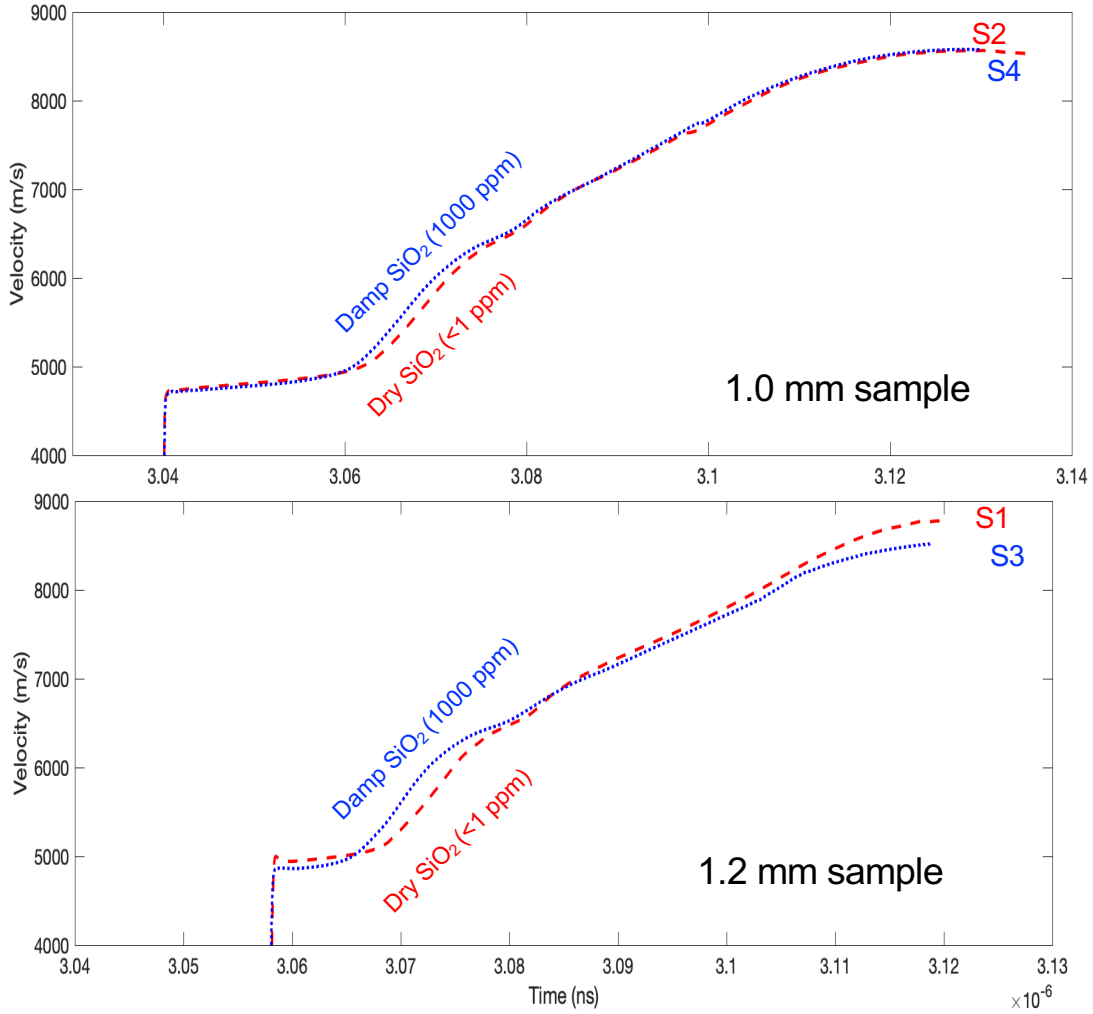
Z3414: 2 Drive – 6 Samples

Shock-Ramp Experiments

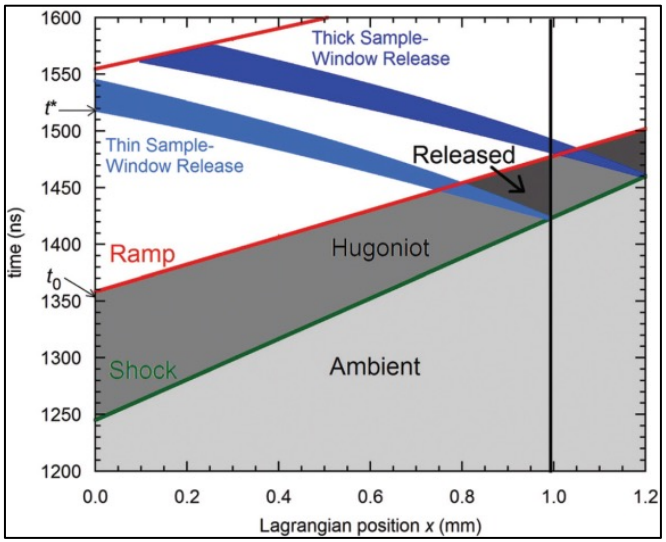




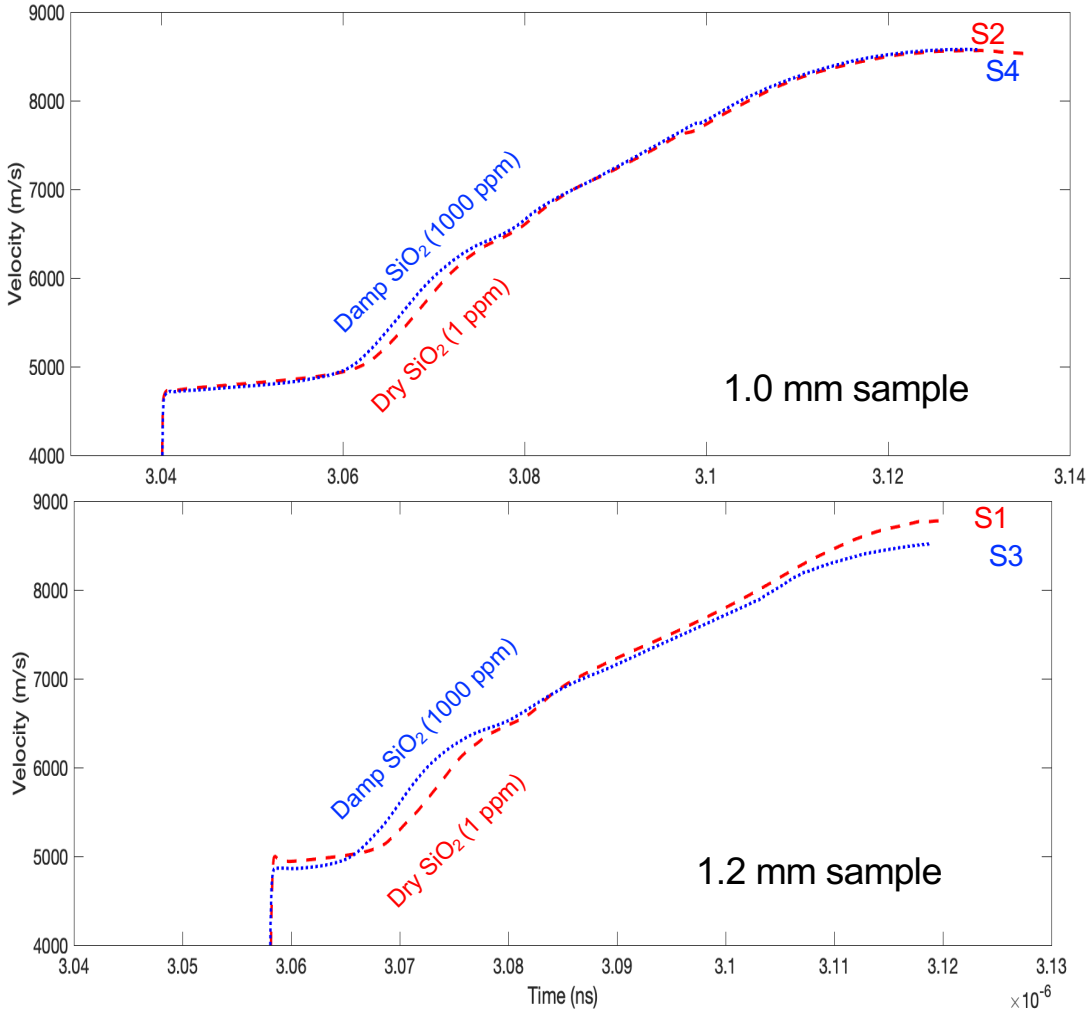
Measured Velocity



Measured Velocity

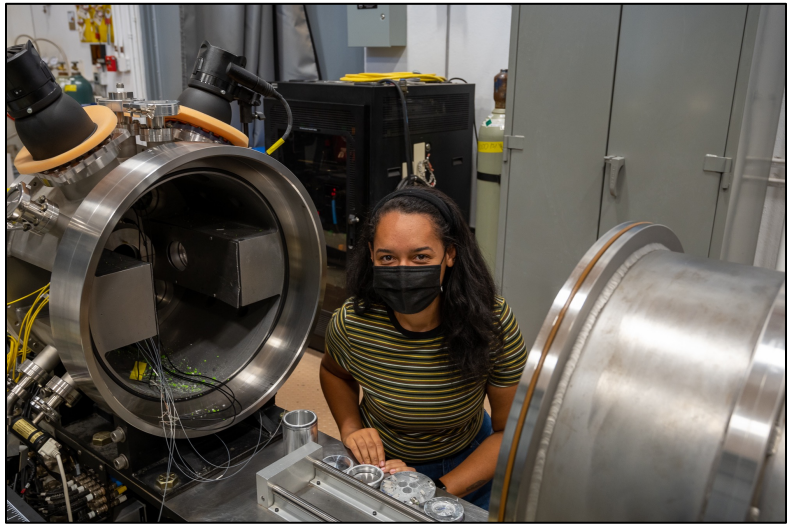


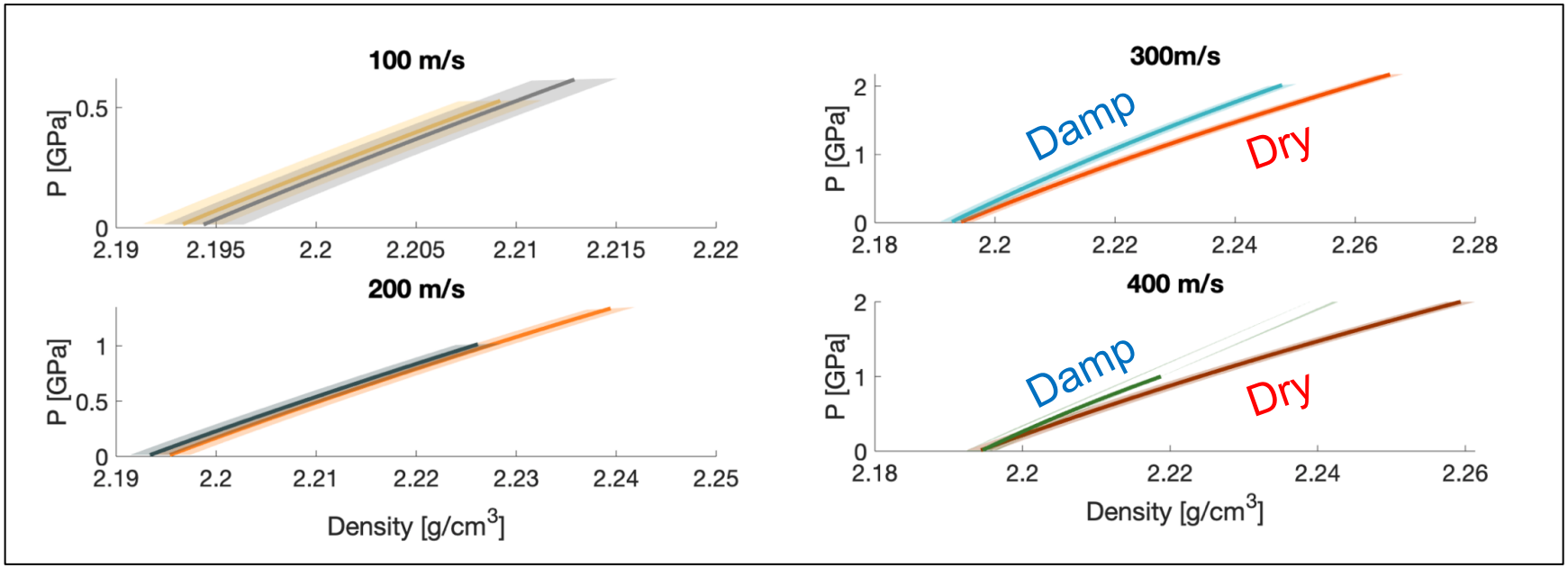
Seagle et al. 2013



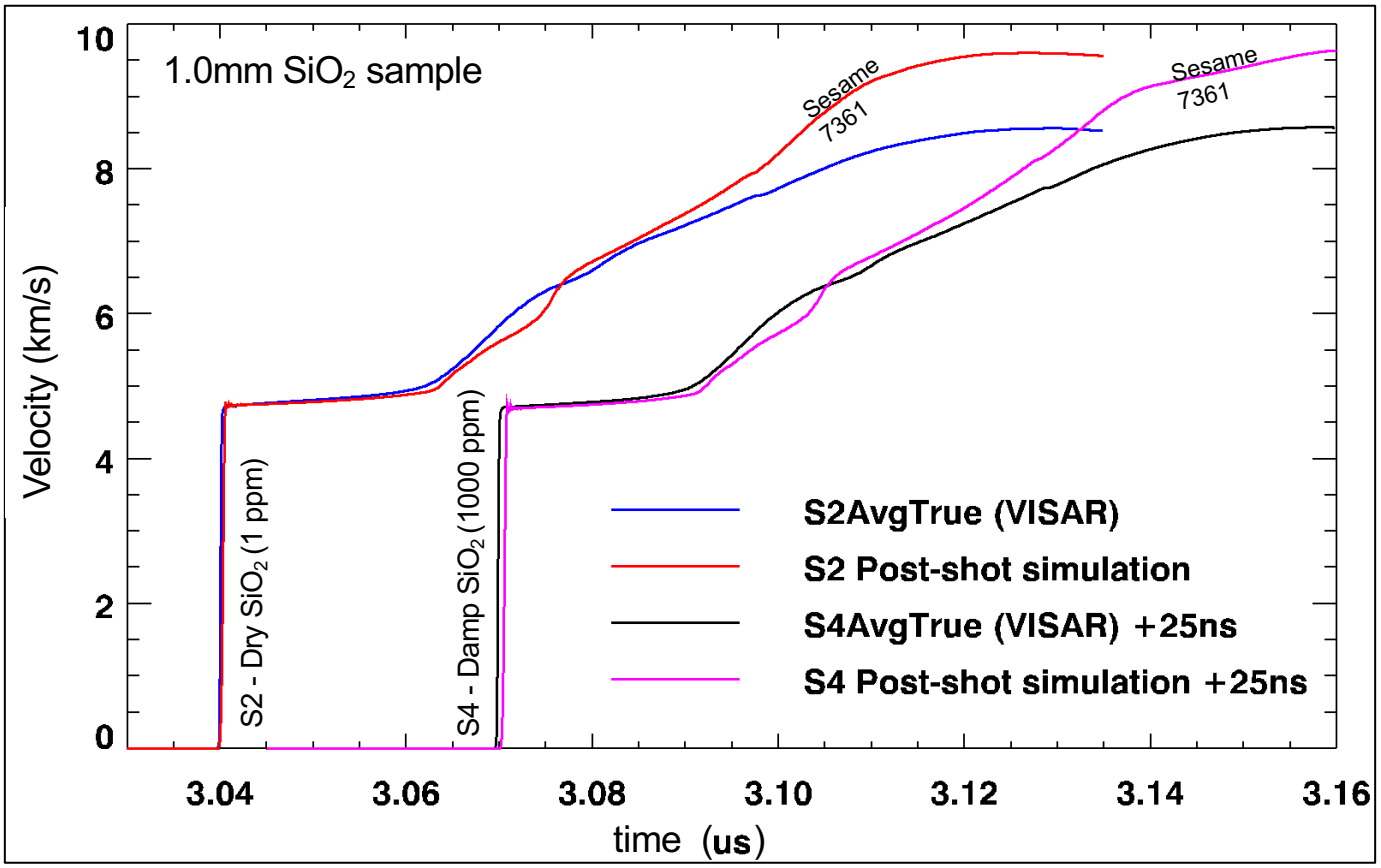
DICE Gas Gun

Part of the dissertation work of Melia Kendall.
Damp glass is less compressible than dry SiO_2 above 200m/s impact velocity.

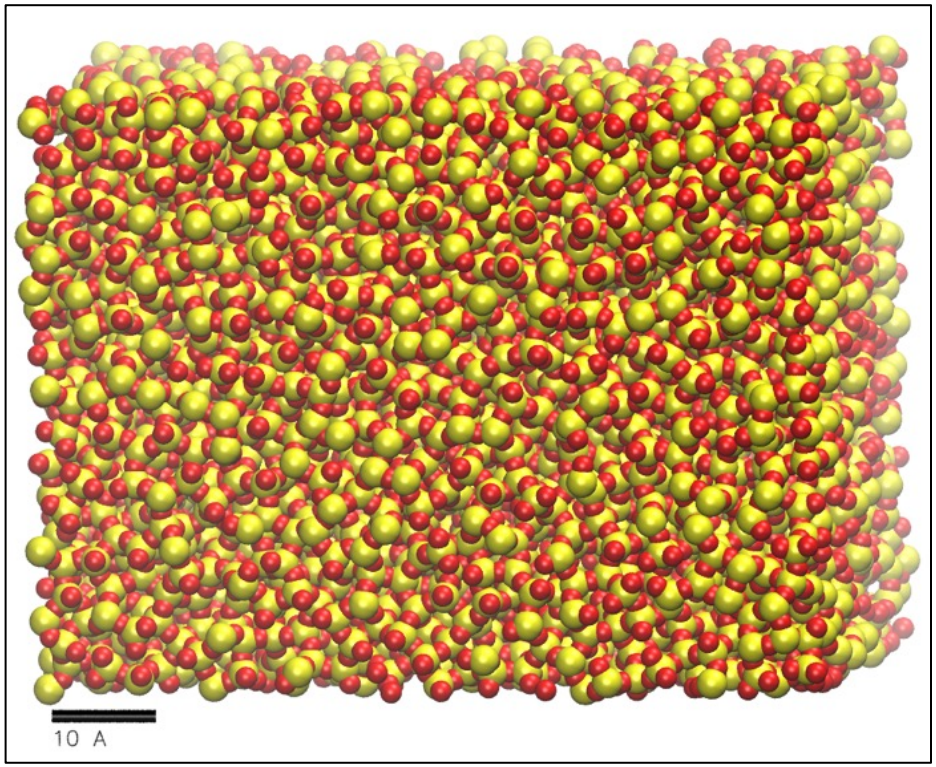




Velocity comparison with Sesame 7361



MOLECULAR DYNAMICS – LAMMPS



MD simulation from LAMMPS of silica (SiO_2) Image from J.M.D. Lane.

- Hugoniot of SiO_2
- Dry and water bearing compositions
- 1-100+ GPa

THANK YOU

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