

**Supplemental Materials**

**for**

**Detection of thin film phase transformations at high-pressure and  
high-temperature in a diamond anvil cell**

Meryem Berrada<sup>1,2</sup>, Genzhi Hu<sup>3</sup>, Dongyuan Zhou<sup>2</sup>, Siheng Wang<sup>1</sup>, Phuong Q. H. Nguyen<sup>1,4</sup>,  
Dongzhou Zhang<sup>1,4</sup>, Vitali Prakapenka<sup>4</sup>, Stella Chariton<sup>4</sup>, Bin Chen<sup>1</sup>, Jie Li<sup>2</sup>, Jason D. Nicholas<sup>3,5\*</sup>

<sup>1</sup> Hawaii Institute of Geophysics and Planetology, University of Hawaii at Manoa, Honolulu, HI, USA

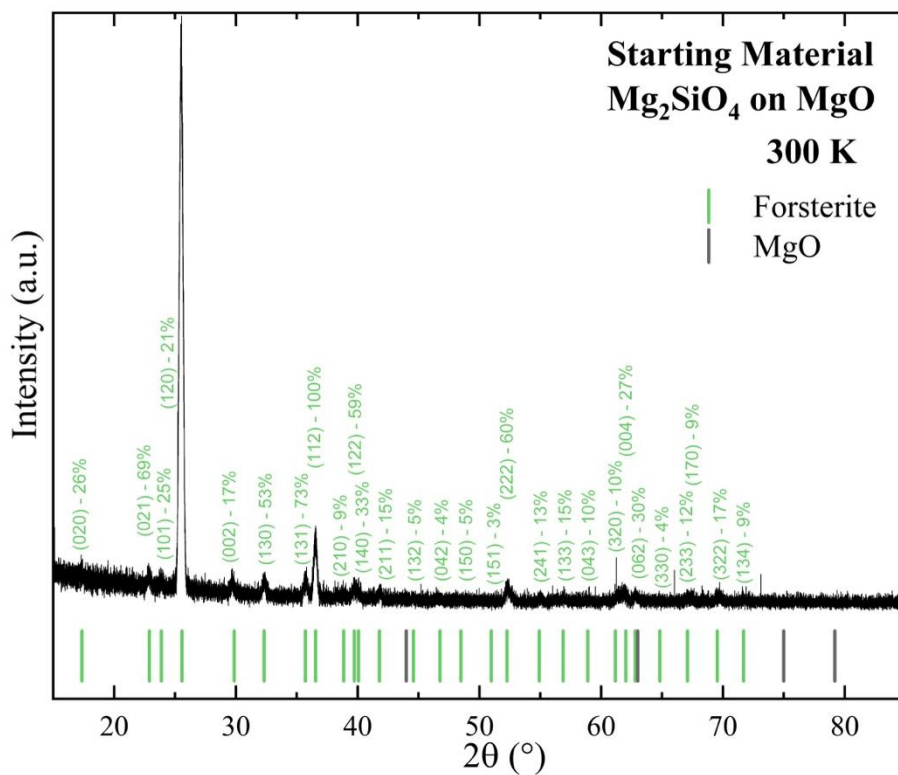
<sup>2</sup> Earth and Environmental Sciences Dept., University of Michigan, Ann Arbor, MI, USA

<sup>3</sup> Chemical Eng. & Materials Science Dept., Michigan State University, East Lansing, MI, USA

<sup>4</sup> Center for Advanced Radiation Sources, The University of Chicago, Chicago, IL, USA

<sup>5</sup> Fraunhofer USA Center Midwest, Coatings and Diamond Technology Division, East Lansing, MI, USA

[\\*jdn@msu.edu](mailto:*jdn@msu.edu)



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17 **Figure S1.** Grazing Incidence X-Ray Diffractogram of the  $\text{Mg}_2\text{SiO}_4/\text{MgO}$  sample at 300K after 1  
 18 hour of 1473K annealing in air. Forsterite peaks are compared to PDF#00-004-0768, and  
 19 periclase peaks are compared to PDF#00-004-0829. The percentage values next to each (hkl) peak  
 20 refers to the relative intensity of a randomly oriented polycrystal of forsterite as reported in  
 21 PDF#00-004-0768.

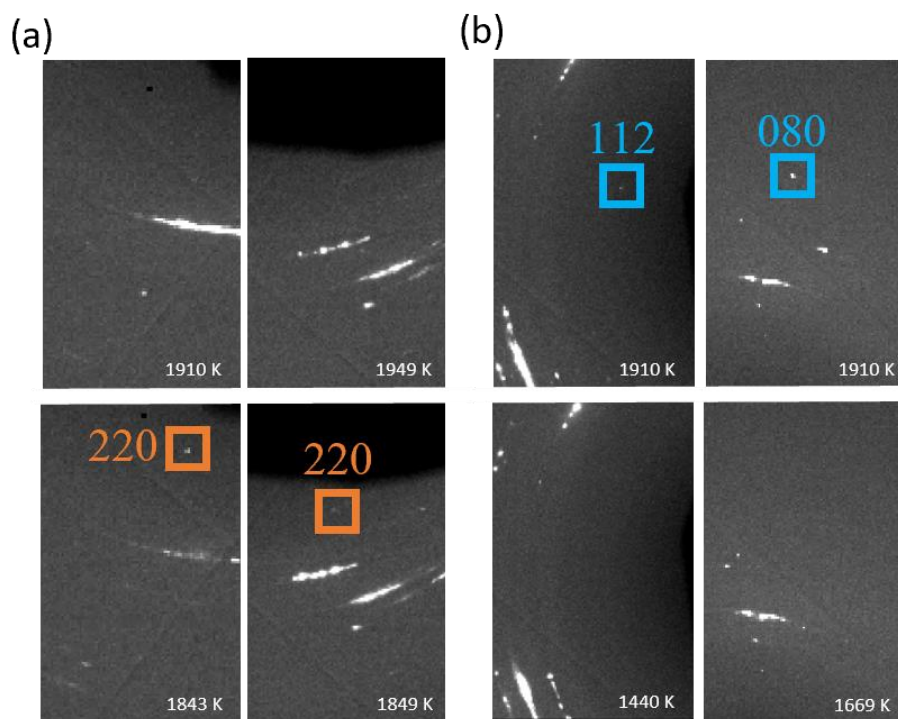
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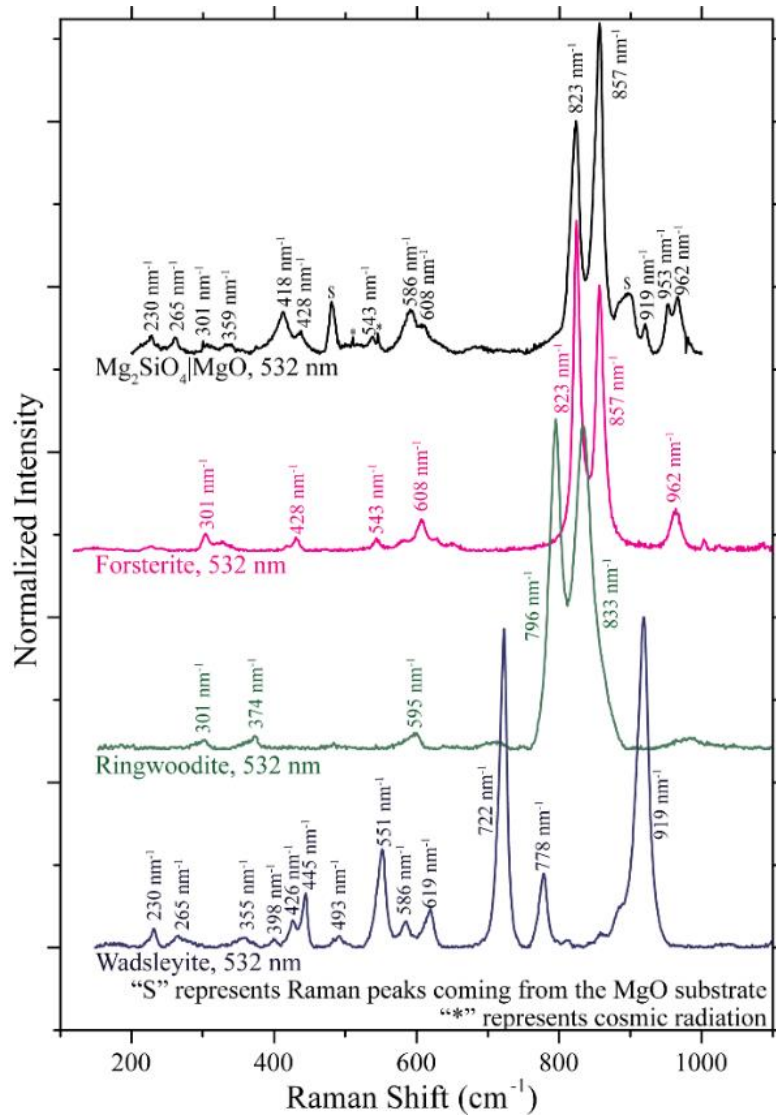
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28 **Figure S2.** Closeups of the XRD ring patterns near the (a) ringwoodite 220 peak and (b)  
29 wadsleyite 080 and 112 peaks showing a ringwoodite to wadsleyite phase change near 1900 K  
30 and  $18.2 \pm 0.2$  GPa.



**Figure S3.** Raman spectrum of a Mg<sub>2</sub>SiO<sub>4</sub>/MgO sample at 300 K after annealing at 1473 K in air, compared to reference Raman spectra from the literature.<sup>1-3</sup>



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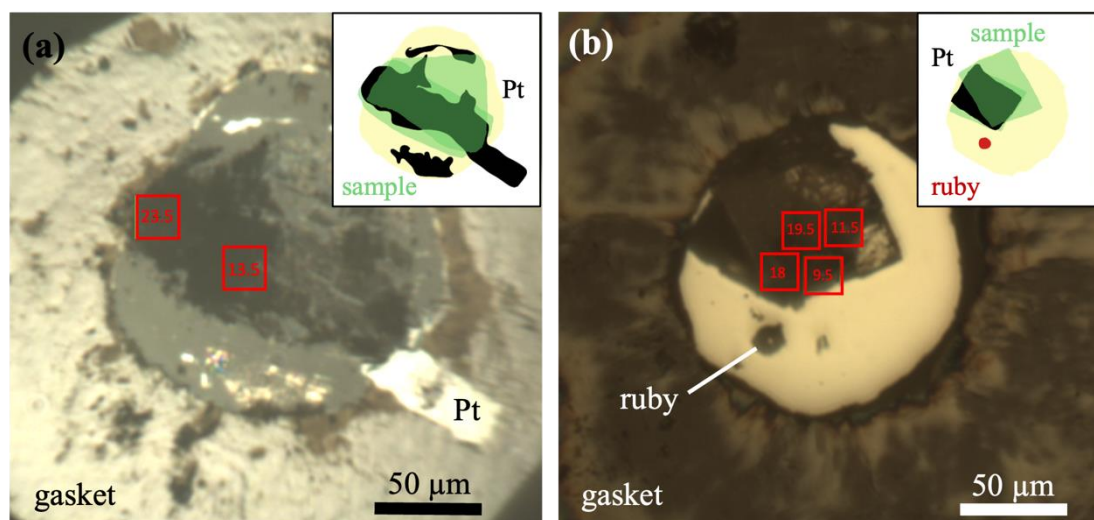
**Figure S4.** A  $\text{Mg}_2\text{SiO}_4/\text{MgO}$  fragment attached to the 38 mm diameter piston of a powder pressing piston-die set. The film is facing the piston, and the Crystalbond applied along the edges of the sample ensured no water reached the film in the center of the sample during wet polishing. Placing the piston in the outer die during hand polishing on SiC paper helped keep the sample flat and level during polishing.

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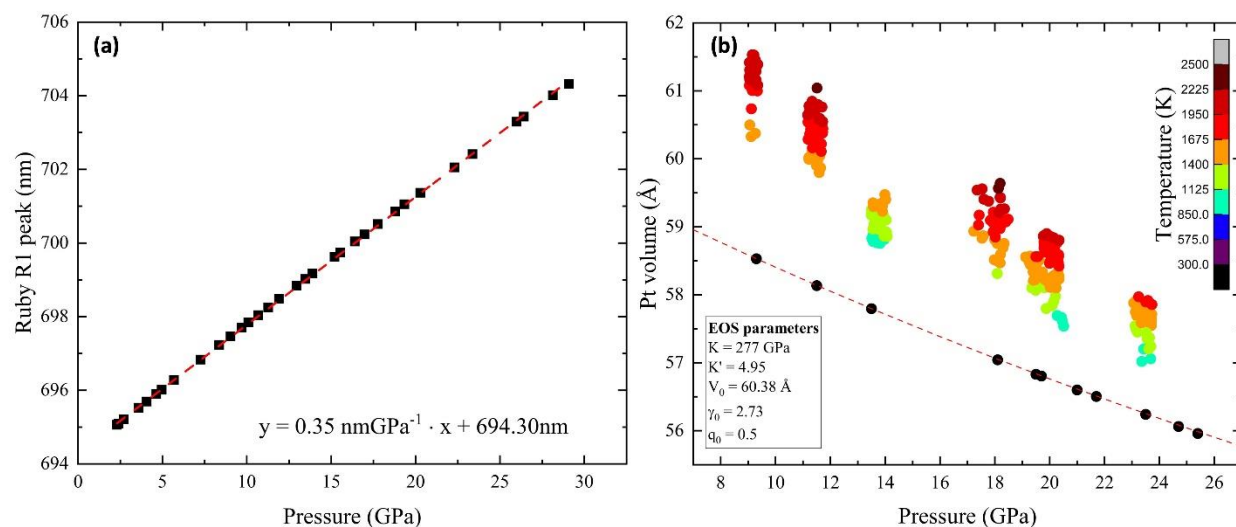
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**Figure S5.** Positions (denoted by the red boxes) used for the laser-heated XRD measurements. The numbers inside the boxes correspond to the approximate pressure (GPa) at which the measurements on that spot were taken. (a) Top view of the assembly inside the Re gasket of Run #1. (b) Top view of the assembly inside the Re gasket of Run #2. A diagram of each assembly, where Pt is in black, ruby in red, and the thin film sample (Mg<sub>2</sub>SiO<sub>4</sub> on MgO) in green, is also displayed.



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55 **Figure S6. (a)** Fit of the R1 ruby fluorescence peak at 300 K.<sup>4</sup> Under high pressure, the ruby R1  
 56 peak shifts to higher frequencies due to the pressure-induced compression of the crystal lattice  
 57 following the formula  $y = 0.35 \text{ nmGPa}^{-1} \cdot x + 694.30 \text{ nm}$ . **(b)** Estimated pressures via the Equation  
 58 of State (EOS) of Pt using a reference volume ( $V_0$ ) of 60.38 Å, a bulk modulus ( $K$ ) of 277 GPa, and  
 59 the derivative of the bulk modulus ( $K'$ ) of 4.95.<sup>5</sup>

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## 62 Supplementary References

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