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The Stability of $MgSiO_3$ Perovskite at Lower Mantle Conditions[1]

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— The stability of $MgSiO_3$-perovskite at lower mantle conditions has been a subject of extensive investigation and debate. Shock recovery experiments with the initial sample of $(Mg_{0.92}, Fe_{0.08})SiO_3$ enstatite and $MgO+SiO_2$ were conducted up to 120GPa. The analysis of XRD results indicate that there is no possibility for the chemical decomposition from $(Mg_{0.92}, Fe_{0.08})SiO_3$ to oxides SiO_2 and $(Mg_{0.92}, Fe_{0.08})O$ under experimental shock pressure. The Gibbs energy and molar volume of all phases in the reaction $MgSiO_3(Pv) = MgO(Pe) + SiO_2(St)$ are calculated using both the latest experimental thermodynamic parameters and the first principle molecular dynamic (MD) simulations under lower mantle conditions (1000-3500K and 30-150GPa)., and the results show that perovskite is thermodynamically stable relative to the stishovite and periclase assemblage at lower mantle conditions.

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