

## **The Effect of Nickel on the Strength of Hcp-Iron at High-Pressure**

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### **Abstract:**

Hydrostatic nuclear resonance inelastic x-ray scattering coupled with non-hydrostatic radial x-ray diffraction measurements can be used to determine the shear strength of Fe-bearing materials at core pressures. Using the Singh et al. formalism (2006), the bulk shear strength ( $\tau$ ) of a material is related to its shear modulus ( $G$ ) and to the average differential strain ( $\langle Q(hkl) \rangle$ ) over all measured lattice planes ( $hkl$ ) by  $\tau = 6G\langle Q(hkl) \rangle$ . We followed an existing framework (Gleason & Mao, 2013) and extend the strength determinations to investigate the effect of nickel on the strength of iron at high pressure. We collected radial X-ray diffraction data on  $Fe_{90}Ni_{10}$  and  $Fe_{80}Ni_{20}$  using a panoramic diamond anvil cell with an X-ray transparent gasket to 60 GPa. This data was combined with existing NRIXS data (Lin 2003) to calculate the strength of these compounds. The strength of these iron-nickel alloys could be extrapolated to deep earth pressures to give constraints on the state of the inner core. Gaining a better understanding of the strength of iron and its alloys at high pressures can shed light on the strength of the inner core and provide insight into the deformation processes operating in the most remote region of our planet.