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On the Composition and Temperature of the Terrestrial Planetary Core[1]

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The existence of liquid cores of terrestrial planets such as the Earth, Mar, and Mercury has been supported by various observation. The liquid state of the core provides a unique opportunity for us to estimate the temperature of the core if we know the melting temperature of the core materials at core pressure. Dynamic compression by shock wave, laser-heating in diamond-anvil cell, and resistance-heating in the multi-anvil device can melt core materials over a wide pressure range. There have been significant advances in both dynamic and static experimental techniques and characterization tool. In this tal, I will review some of the recent advances and results relevant to the composition and thermal state of the terrestrial core. I will also present new development to analyze the quenched samples recovered from laser-heating diamond-anvil cell experiments using combination of focused ion beam milling, high-resolution SEM imaging, and quantitative chemical analysi. With precision milling of the laser-heating spo, the melting point and element partitioning between solid and liquid can be precisely determined. It is also possible to re-construct 3D image of the laser-heating spot at multi-megabar pressures to better constrain melting point and understanding melting process. The new techniques allow us to extend precise measurements of melting relations to core pressures, providing better constraint on the temperature of the cor.

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