高圧下における鉄ー炭素合金メルトの熱弾性的性質：月内部における炭素への応用

Thermoelastic properties of iron-carbide melts under high pressure: implication for carbon in the lunar interior

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Carbon is one of the possible light elements in lunar interior. Thus, it is important to understanding the effect of density and sound velocity of liquid Fe at high pressure in order to evaluate the presence of carbon in lunar core. Simultaneous measurements of P-wave velocity and the density of liquid Fe-C have been conducted up to 3.4 GPa and 1850 K. Addition of carbon decreased the V_P of liquid Fe by about 2% at 3 GPa and 1700 K and reduced Fe density by about 2% at 2 GPa and 1700 K. The V_P of liquid Fe-3.5 wt% C decreased linearly with increasing temperature at constant pressure. The bulk modulus of liquid Fe-C and its pressure (P) and temperature (T) effects were precisely determined from directly measured r and V_P data to be $K_{0,1700K}$ = 83.9 GPa, dK_T/dP = 5.9(2), and dK_T/dT = −0.063(8) GPa/K. The effect of carbon in the Birch (r–V_P) plot decreases with increasing pressure. Based on the directly measured V_P and r of liquid Fe-C, elastic properties, such as K, dK/dT, and dK/dP, were determined precisely. These properties can explain differences in dV_P/dT of Fe-C, Fe, and Fe-S.

キーワード：月、外核、液体、音速、密度、弾性率
Keywords: Moon, Outer core, liquid, sound velocity, density, bulk modulus

