# Chemical interaction between core and mantle and evolution of the core

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Recent advances of high-pressure experimental techniques using synchrotron X-rays or high-resolution transmission electron microprobe has revealed the deep mantle processes. Chemical reaction between molten iron and silicates at the core-mantle boundary could have large effects on the evolution of core and mantle. We have conducted reaction experiments between liquid iron and $(Mg_{0.9}Fe_{0.1})SiO_3$-perovskite to 79 GPa using laser-heated diamond-anvil cell (LHDAC). Results demonstrated that quenched liquid iron contained substantial amounts of oxygen and silicon as pressure and temperature increase. Density deficit of the outer core from the pure iron (~7 % estimated by [1]) can be explained by the dissolution of oxygen and silicon in molten iron from coexisting $(Mg,Fe)SiO_3$-perovskite at 79 GPa and 3500 K. Since the liquid iron most likely incorporates more oxygen and silicon at higher pressures, this suggests that oxygen and silicon are currently being dissolved from the silicate mantle into the liquid iron core at the core-mantle boundary (135 GPa). Amount of these light elements in the core may have increased since early Earth. It has long been believed that the Earth's inner core has grown with time by cooling. However, the dissolution of oxygen and silicon at the core-mantle boundary reduces the melting temperature of iron, and it is possible that the size of inner core has decreased with time depending on its thermal history.

[1] Anderson and Issak (2002): EPSL, 131, 19-27.