In order to *in situ* observe the formation and stability of Mg_2C under high pressures and high temperatures, the mixture of Mg and glassy carbon has been compressed to 18 GPa and probed by X-ray diffraction (XRD) during heating. The sequence of XRD patterns has been obtained at ID07 beamline of ESRF using newly installed large-volume press allowing to probe the large enough amount (1-3 mm^3) of light-element samples to obtain a good quality powder diffraction paterns under pressures at least up to 20 GPa. Pressure and temperature have been estimated using the *p-V-T* equations of state of Mg and MgO.

The formation of Mg_2C was observed at ~1500 K below the magnesium melting temperature which can be estimated as 1600-1850 K at 18 GPa (Figure). This can be explained by metastable eutectic melting of Mg and its interaction with glassy carbon. After the formation of Mg_2C, the isothermal decompression at ~1550 K has been performed, and at pressures below ~12 GPa the new reflections have been observed, indicative that Mg_2C is stable only above ~12 GPa at 1550 K.

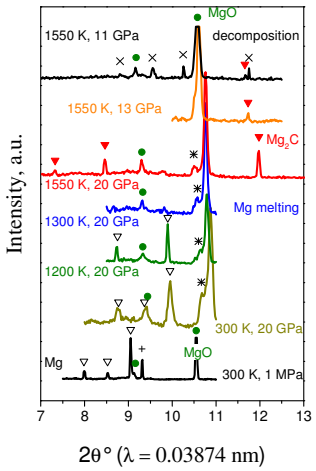

Figure. A sequence of *in situ* X-ray powder diffraction patterns of Mg-C sample, taken during compression to 18 GPa (at 300 K), heating to 1550 K (at ~18 GPa) and subsequent isothermal decompression (at ~1550 K). The formation of Mg_2C was observed during heating at 18 GPa after the non-equilibrium melting of Mg at ~1500 K. At 1550 K Mg_2C decomposes at the pressure of ~ 12 GPa.