The 418th Geodynamics Seminar

AlCuFe quasicrystal at high pressure and temperature: implications for the origin of icosaedrite in Kharyrka meteorite

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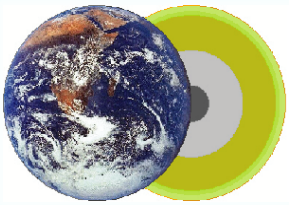

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Abstract

Icosahedrite, the first natural quasicrystal with composition $Al_{63}Cu_{24}Fe_{13}$, was discovered in several grains of the Khatyrka meteorite, a CV3 carbonaceous chondrite. The presence of icosahedrite associated with high-pressure phases like ahrensite and stishovite indicates formation at high pressures and temperatures due to an impact-induced shock. Previous experimental studies on the stability of synthetic icosahedral AlCuFe have either been limited to ambient pressure or limited to room temperature, for which they indicate structural stability up to about 35 GPa. These data, however, are insufficient to experimentally constrain the formation and thermodynamic stability of icosahedrite under the conditions for the formation of Khatyrka meteorite. Today, I will present preliminary results of room-temperature, high pressure diamond anvil cells measurements of the compressional behavior of synthetic icosahedrite up to ~50 GPa. High *P-T* experiments were also carried out using both laser-heated diamond anvil cells combined with in situ synchrotron X-ray diffraction and multi-anvil apparatus to investigate the structural evolution and crystallization of possible coexisting phases. The results demonstrate that the quasiperiodic order of icosahedrite is retained over the *P-T* range explored. Direct solidification of Al-Cu-Fe quasicrystals from an unusual Al-Cu-rich melt is possible but it is limited to a narrow temperature range. Alternatively, quasicrystals may form after crystallization through solid-solid reactions of Al-rich phases.

詳細は当センターホームページ：http://www.grc.ehime-u.ac.jp/ をご覧ください
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