[EJ] Eveningポスター発表 | セッション記号 P (宇宙惑星科学) | P-PS 惑星科学

[P-PS06] 太陽系物質進化

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原始太陽系星雲における物質形成から原始惑星への集積、天体内部や表面での諸過程を隕石や他の惑星物質に対する研究と実験的研究の両面から議論する。初期太陽系の情報を保存する始原的物質（コンドライト隕石や惑星間塵、サンプルリターン試料）に関しては、それらの鉱物・有機物・水・希ガス・微量元素分析を通して明らかになった知見を総合理解することを目指す。分析手法開発研究（化学、理論、物性）や学生の萌芽的研究を歓迎し、将来の太陽系、惑星系形成研究の新たな開拓につなげたい。さらに分化隕石やコンドライト母天体における水質変成・熱変成作用、火成活動、コア・マントル・地殻形成、並びに天体衝突といった現象に加えて、母天体の内部構造や構成物質などについても議論する。実験的手法による惑星物質の組成、相平衡や構造に関する知見なども取り上げ、隕石とあわせて天体における諸過程を議論する。

[PPS06-P14]放射光 X線回折を用いた石英の衝撃誘起ガラス化解析

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キーワード：石英、衝突実験、XRD

High-density silica glass is often observed in meteorites and terrestrial rocks that have experienced a heavy shock impact event in parent bodies and on terrestrial impact craters. The shock-induced silica glasses exist as lamellar microstructures in the crystalline quartz grains[AM1] (i.e., PDFs: planar deformation feature) in meteorites and impactites. Thus, the mineralogical properties of PDFs are used as an indicator for the shock pressure estimation [e.g., 1]. However, shock induced amorphization process that forms PDFs still remains question. In this study, we investigated the structural change of quartz into high-density silica glass with an increase of experimentally shock-induced pressure by synchrotron powder X-ray diffraction (XRD) measurement.

Reverberation shock experiments were performed for single crystals of terrestrial (Minas Gerais, Brazil) and synthetic quartz using a one stage propellant gun at National Institute for Material Science (NIMS). Powder XRD patterns of silicon as a standard, starting materials of quartz, and the shock-recovered samples were conducted at KEK Photon Factory (PF; beam line: PF BL-4B2). Powder XRD measurement is analyzed in the range of 8 to 150 degree with steps of 0.005 to 0.2 degree, where the X-ray irradiation time set at 2 to 5 seconds per steps.

X-ray diffraction patterns of the starting materials and the shock-recovered samples of quartz crystals demonstrates that the diffraction peaks become broader as the shock pressures increase. The FHWM of main diffraction peaks (e.g., lattice plane [010], [110], etc..) increases with shock pressure. Above 35 GPa, no diffraction pattern of quartz was identified from the shock-recovered samples, suggesting the complete transition of quartz to amorphous glass. Also, several crystal planes exhibit peak shifts with the pressure increase. Lattice parameter of quartz changes at pressure range of 5 ~ 35 GPa. For both a-axis and c-axis, the lattice parameter becomes higher as the increase of pressure. These results imply that the lattice expansion of quartz occurs depending on a formation of high-density silica glass at this pressure range. Additionally, the micro-strain increases and the crystallite size decreases with pressure increase, suggesting that the shock-induced amorphization was initiated by the lattice distortion and the structural defects induced by shock compression. Also, the response of XRD signals with shock pressure would be potentially available for a shock barometer for meteorites and impactites.

[1] Langenhorst (1994) EPSL