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Future of planetary material science

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Recent success in collecting solid materials from inerplanetary space (the Stardust mission) and a small body (the Hayabusa mission) show the coming of new era, when we will be able to understand the evolution of the protoplanetary disc through studies on solid materials which had interacted with the gas. We are realizing that the evolution has been largely affected by interactions among silicates, organic materials, and water (ice), among which organics and ice had been hardly observed in situ, and only information about isotopic signature were recorded. The collected samples from the interplanetary space of primitive small bodies could retain information on the primitive materials. If we know the initial condition of the solid materials, such as phase, size, and occurrence of multiple phases, we will be able to predict the evolution of those materials as a function of pressure, temperature, and time, for which systematic experiments are required. One of the most important roles of the planetary material science in future is to give information that are applied to physics and dynamics of a protoplanetary disc. In order to do so, we need to develop a tool to convert qualitative information into quantitative information. The work will predicts the simultaneous evolution of solid materials and disc, which is crucial for the composition of precursor materials of planets as a function of distance from the central star.

Keywords: solid materials, star, origin, planets, evolution