Oral | Symbol P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS21_29AM2]Planetary Sciences

Convener:*Satoshi Okuzumi(Graduate School of Science, Tokyo Institute of Technology), Kosuke Kurosawa(Planetary Exploration Research Center, Chiba Institute of Technology), Chair:Peng Hong(Department of Complexity Science and Engineering, Graduate School of Frontier Sciences, The University of Tokyo), Masanori Onishi(Graduate School of Science, Kobe University)

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We call for general interest papers for Planetary Sciences. Planetary Sciences consist of a variety of studies on the past, present, and future of our solar system and exoplanetary systems. Discussions based on various backgrounds are encouraged.

12:30 PM - 12:45 PM

[PPS21-P19_PG]Measurement experiments of thermal conductivity and sound velocity in sintered glass beads

3-min talk in an oral session

Shoko TSUDA[1], *Kazunori OGAWA[1], Naoya SAKATANI[2], Masahiko ARAKAWA[3], Minami YASUI[3] (1.The University of Tokyo, 2.The Graduate University for Advanced Studies, 3.Kobe University)

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The thermal conductivity and sound velocity of sintered particle materials (glass beads) were experimentally measured, and a correlation between them was investigated. Particles have often played important roles in the solar system history. Especially dust particles condensed in the early solar nebula formed planetesimals, and they remained as the main structure material of the bodies. The particles were then gradually sintered as temperature increased by disintegrations of radioactive isotopes. Finally, a part of planetesimals might be completely sintered and began to melt. Currently the sintered materials may also exist on the lunar and asteroid subsurface for example. Mechanical and thermal properties of such sintered materials are essential information for investigating the history of these bodies.In the thermal issues, particles are known as a strong thermal insulator in vacuum. Although the thermal conductivity of sintered materials has never been measured, it is considered to be a value between the unsintered and a continuous rock, depending on degree of the sintering process. Concerning the sound velocity, characteristic feature depending on the sintering degree is expected to be similar to the thermal conductivity, because basically the phonon conduction is a common mechanism for both the thermal and sound phenomena in electrical insulation materials.In this presentation, we report results of the first experiments of the thermal conductivity and sound velocity measurements in sintered particle materials. For measurement samples, 9 different blocks of sintered soda-lime glass beads were prepared: three bead diameters of 180-255, 355-500, and 710-1000 μ m, and three degrees of sintering that have nearly the same porosity 40%. The cross section of sintering contact sites (neck) was evaluated for each sample. The thermal conductivity was measured by the line heat source method by a line heater and temperature sensors given in the sample in advance. The sound velocity was directly measured by a transmitter and receiver put at both ends of the block samples.As results of the experiments, both the thermal conductivity and the sound velocity had an apparent correlation with each other, and with degree of sintering. They appeared almost in proportion to the neck diameter, which feature obviously indicates that the neck or contact size controls the bulk thermal and sound conductions, in weakly-sintered particle systems at least. These results can be directly applied to estimation of thermal and mechanical property of the ancient planetesimals. These results also suggest that the thermal

conductivity of sintered materials, and also of unsintered particles probably, can be evaluated by measurements of the sound velocity.