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# Tensile, crushing, and impact strength and their relationships for chondrules and other rock samples

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There are different scenarios for chondrule formation. Chondrules are thought to be captured into chondrites after their formation, then underwent collisional and thermal evolutions. Beitz et al. (2013) studied the relationship between pressure and porosity based on impact compression experiments of simulated chondrite samples. They showed that the maximum pressure which chondrite parent bodies experienced can be estimated from the tensile strength of chondrules and the fraction of intact chondrules. However, the tensile strength of chondrules is not known. Therefore we started to estimate the tensile strength of chondrules in order to discuss the maximum pressure chondrite parent bodies experienced.

The strength measurable for chondrules is crushing strength of spherical samples. Generally, tensile strength is measured using shaped samples, while it is difficult to shape chondrules. In stead, we estimate the tensile strength from the crushing strength of chondrules assuming that the relationship between these strengths of other samples can be applied to those of chondrules.

Static compression experiments of about 30 chondrules showed that the crushing strength of chondrules is around 8 MPa (Shigaki & Nakamura, Fall meeting of The Japanese Society for Planetary Sciences 2014). It is shown from the measurement of the strength of dunite samples that crushing strength and tensile strength are almost equivalent. Furthermore, we tried to estimate the crushing strength from impact strength. Using the results of impact disruption experiments of chondrules (Ueda et al., 2001), we found that the crushing strength of chondrules might possibly be stronger (˜30MPa). The inconsistency of the values of crushing strength can be due to different relationships between these strengths for different silicate materials.

In this study, we employed more variety of rock samples to examine their tensile, crushing, and impact strengths and their relationships, in order to obtain more reliable tensile strength of chondrules. We prepared disk and spherical samples of dunite, basalt, Berea sandstone, and tuffaceous sandstone. While chondrules were removed from Allende (CV3) specimens in the previous experiment using tweezers and files, we separated them from matrix by means of Freeze-thaw method. We will perform impact experiments of chondrules onto a stainless steel plate to obtain the impact strength of chondrules.

In this presentation, we will introduce our results of all samples used so far and discuss the tensile strength of chondrules estimated from the relationships of these strengths for the different silicate samples.

Keywords: chondrites, chondrules