Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PPS21-P13 Room:Convention Hall Time:May 22 17:15-18:30

Effects of H2 Dissociation and Recombination on Planetesimal Bow Shocks

YAMAZAKI, Fumika[1*], NAKAMOTO, Taishi[1]

[1]Department of Earth and Planetary Sciences, Tokyo Institute of Technology

Chondrules are mm-sized particles included in many meteorites. There are evidences that they have experienced heating and melting, but the details of the heating event are still unknown. One of the ideas for heating mechanism is the shock wave heating model. The model explains that, when the precursor dust grains run into the shock, they experience the gas drag heating, and dust temperature exceeds the melting point. Based on this idea, Ciesla et al. (2004) and Nakajima et al. (2012, in preparation) conducted numerical simulations of planetesimal bow shocks and examined them as a chondrule formation site. They assumed that the gas consists of hydrogen molecules and the gas changes adiabatically; the effects of H_2 dissociation and recombination were ignored. However, the calculated temperature behind the shock front was 4000K or more (Nakajima et al. 2012, in preparation), so H_2 dissociation is expected to occur. Once the dissociation of H_2 takes place, the resultant temperature of the gas would be different. Thus, to understand bow shocks around planetesimals, the gas flow should be investigated with H_2 dissociation/recombination.

We conduct numerical hydrodynamics simulation with H_2 dissociation and recombination around planetesimals. We develop an equilibrium calculation code of H_2 dissociation/recombination and add it to the ZEUS-2D code.

Our simulation results show that the gas temperature is lower and the density is higher in front of planetesimals than the results by adiabatic calculations. This can be understood as a result of the H_2 dissociation. Moreover, in the region where the recombination occurs, the temperature is higher than the one of adiabatic calculation. Also the positions and the figurations of the shock fronts are slightly different between both calculation results.

These results suggest that the H_2 dissociation and recombination may affect the heating of chondrule precursors. That is because the gas drug heating is susceptible to the gas density. So, the thermal history of dust particles under the effect of H_2 dissociation/recombination should be investigated in the future.

Keywords: bowshock, numerical hydrodynamics simulation, H2 dissociation, chondrule