

## Experimental study on effects of interstellar organic materials on the coagulation of solid particles

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We have performed experiments to understand the effects of organic materials on the coagulation of solid particles. Experimental results clearly show that organic materials are very effective on the coagulation of solid particles. We suggest that the coagulation of solid particles proceed rapidly by organic materials in 2-3AU compared with <2AU and >3AU.

To form planets in the early solar nebula, small solid particles must aggregate together by collision and following sticking. Although the importance of the understanding of sticking mechanisms on the growth of solid particles has been realized implicitly, there has been no experiment carried out. We have directed our attention to organic materials coated solid particles. We have performed various kind of experiments to understand the effects of organic materials on the coagulation of solid particles.

In all experiments, we used glycerin and model organic material instead of interstellar organic materials. Head-on collision experiments were performed between copper sphere and organic materials coated copper block at 200-300 K. The sticking threshold velocity increases with decreasing temperature, attaining a maximum value of 5 m/s at about 250K, and then decreases. Experimental results clearly show that organic materials are very effective on the coagulation of solid particles compared with ice and silicate, and that the coagulation of solid particles occurs even at a impact velocities of the order of m/s.

To analyze these results, we measured the temperature dependence of surface sticking force, viscosity and elasticity of organic materials. We made a simplified visco-elastic fluid model considering the sticking force, viscosity and elasticity. From this model, the temperature dependence of the sticking threshold velocity has been explained mainly by viscosity and elasticity of organic materials. Based on these results, we suggest that the coagulation of solid particles proceeded rapidly by organic materials in 2-3AU compared with <2AU and >3AU.