# Numerical simulation of crystal growth in supersaturated solution by using Lattice Boltzmann Method

# Hiroyuki Ikeda[1]; Takayuki Miyoshi[2]; Kyosuke Onishi[3]; Yasuhiro Yamada[4]; Toshifumi Matsuoka[5]

[1] Global engineering, Kyoto Univ; [2] Civ. Earth Res. Eng, Kyoto Univ.; [3] Civil & Earth Res. Eng., Kyoto Univ.; [4] Civ. Earth Res. Eng., Kyoto Univ.; [5] Kyoto Univ

1.Background and purpose of our study

Methane hydrate is expected as a new energy resouece, but there are a lot of technical and economical problems to produce it from deep sea floor, such as the production method to avoid possible collapse of the reservoir . This study simulates the process of crystal growth under fluid flow by using the Lattice Boltzmann Method (LBM). Our final purpose is to analyze the crystal growth and to clarify the resolving behavior of methane hydrate in mining.

2.Lattice Boltzmann Method and boundary condition for crystal growth

We use LBM to simulate fluid flow and solute transport. LBM is one of the numeric calculation methods for simulating fluid flow. In this method, fluid is regarded as the group of many particles repeating collision and moving. We get fluid motion for calculating particle motion. Boundary condition is the first kinetic reaction model at the fluid-solid interface. The crystal seed is grown by increasing the mass of the initial crystal in each time step, and a new seed is generated around the lattice unit when the initial mass becomes doubles. we adopt the Damkohler number (Da) to control the shape of the crystal in our study.

3.Results of simulation

The results show that crystal shape changes from round to fractal shape as the Damkohler number increases. Next simulation, we give fluid flow from the left side to the right one to the analytical area. When Da is 2.0, the crystal shape is given little change by fluid flow. When Da is 600, the crystal grows toward the left side. It is because the solute concentration of the left side becomes high by fluid flow and the velocity of the crystal growth becomes large by large Damkohler number.

4.Conclusion

Our study showed that fluid flow and the difference of Da number affects the crystal shape.