Simulation of pouring process of aluminum alloy by smoothed particle hydrodynamics with oxide film model

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ABSTRACT

The die casting is a casting method in which molten metal is injected into a metal mold at high speed, and the product of thin and high strength can be made.

In the die casting process, since the flow of metal inside the manufacturing equipment greatly affects the quality of the product, it is useful if it is possible to clarify the flow behavior during pouring by simulation.

However, unlike water, molten metal used for casting changes flow characteristics by generating oxide film on the melt surface.

Therefore, the pouring experiment with water and that with molten aluminum alloy show large difference of filling time and wave shape, despite the same degree of kinematic viscosity.

In the conventional simulation, adjusting the surface tension or the overall viscosity of the fluid have not reproduced the experiment sufficiently.

In this research, in order to reproduce the behavior difference between pouring water and molten aluminum alloy by the particle-based method, the model in which only particles on the melt surface solidify by oxidation was proposed.

We report the result of verification of this model by comparing the pouring experiment results of water and aluminum alloy and the simulation results by particle method.

In addition, we report the comparison with the case where the pressure gradient force of the fluid is evaluated by an explicit weak compressibility model, and the case where the pressure Poisson equation is implicitly solved and evaluated.

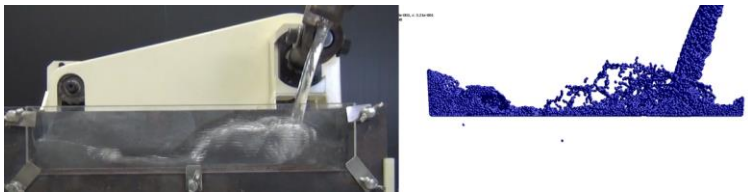

Fig.1 Experiment of water and simulation without surface model.

Fig.2 Experiment of aluminum alloy and simulation with surface model.

REFERENCES

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