

P26

金属積層造形技術の高精度化に向けた  
凝固シミュレーション技術の確立

Simulation of metal solidification process for  
improvement of metal additive manufacturing

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The grain structure of the objects generated by the metal additive manufacturing tends to be anisotropic columnar which results in the reduction of the strength of the structure. There is a demand to find a better manufacturing process that can control the grain structure to be equiaxed microstructures. How the grain is refined is expected to depend on the addition of the heterogeneous nuclei and the intensity of the convection in the liquid phase. As shown in Fig.1, the effect of nuclei addition on the refinement of grains can be simulated using the phase-field method. However, the effect of the interaction of heterogeneous nuclei, liquid convection, and solidification has not been clarified by the previous standard phase-field method. Therefore, this research aims to improve the phase field model so that involves physical models shown in Fig.2. In this way, we realized the numerical simulation of the solidification process with consideration of convection. In the presentation, we will focus on the refinement effect of crystal grains due to the presence of convection and heterogeneous nuclei. This study is a part of [Hetero-3D project].

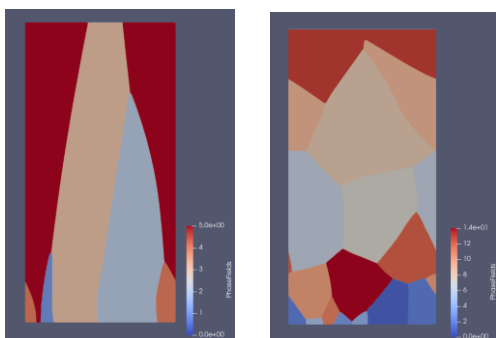


Fig.1 Refinement of grains by addition of heterogeneous nuclei.

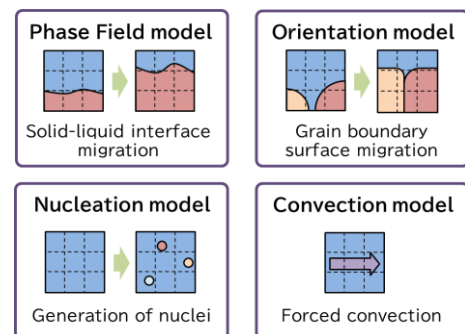


Fig.2 The physical models considered in this study.

References

- 1) P. Holfelder and A. Witte: *PIAM*, Vol. 5, No.3, pp.237-246, apr 2020. DOI: 10.1007/s40964-020-00114-w

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