Large-scale Multi-Phase-Field Simulation of Austenite-to-Ferrite Transformation in Fe-C Alloy using GPU-cluster Computer

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Recently, the multi-phase-field method has attracted much attention as the most promising technique for numerical modelling of microstructure evolution in polycrystalline metal. The multi-phase-field method has already been applied to computer simulation of microstructure evolution during solidification, recrystallization and phase transformation. However, in order to perform three-dimensional (3D) simulation, very high computational cost is required. Therefore, acceleration of the multi-phase-field simulation using a single GPU has been developed by the authors. In this study, we established very high-speed and efficient computing technique for 3D multi-phase-field simulation of austenite-to-ferrite transformation in Fe-C alloy by using multiple GPUs. Furthermore, we implemented this technique on a GPU-cluster computer to perform large-scale simulation.

Keywords: Multi-Phase-Field Method, GPU Computing, Austenite-to-Ferrite Transformation, Fe-C Alloy, Large-scale Simulation