Innovation in Electromagnetic Science of Materials and Its Application to Practical Materials Processing

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【Outline of survey】

Mechanical and functional properties of materials depend significantly on microstructure. It is important to develop an optimal microstructure for obtaining desirable materials properties. In general, thermomechanical treatments have been applied to control microstructures in metallic materials. A new strategy for more precise control of microstructure by application of a magnetic field has been proposed recently (electromagnetic processing of materials, EPM). Extensive studies have been found that a magnetic field can affect many metallurgical phenomena such as recrystallization, phase transformation and precipitation. Nevertheless, it is not necessarily understood as to the origin of magnetic-field effects observed, and few reliable data on the influence of a magnetic field on fundamental phenomena like diffusion and grain/interface boundary energy is available. One main motivation in this work is therefore to investigate how a magnetic field can make an influence on such fundamental phenomena, and then to give basic data to discuss the origin of magnetic-field effects observed. A second is application of EPM to practical materials processing.

【Expected results】

It is a key issue to establish "electromagnetic science of materials", which will guide a principle of EPM, towards innovation in this research field. The results obtained in this study will contribute to establishment of it, and give some points of departure for application of a magnetic field to practical materials processing for achieving enhanced properties and performance of materials through precise control of microstructures.

【References by the principal investigator】

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【Term of project】 FY2007－2011	【Budget allocation】 15,500,000 yen (2007 direct cost)

【Homepage address】 None