열 전달, 상변태, 확산변태소성을 고려한 저탄소강의 Dilatometry 전산모사

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FE Analysis of Dilatometry considering Heat Transfer, Phase Transformation, and Transformation Plasticity

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Abstract

Dilatometry has been used over the last few decades for the study of phase transformations in ferrous alloys. Conventionally, the fraction of individual phases was determined in dilatometry using lever rule which is based on extrapolation of two linear segments of a dilatation curve. Although this method is very convenient to use, however, it might cause significant errors in the result of dilatometry because the method has several assumptions in itself. Many researchers provided the modified methods which can improve the errors caused by the lever rule. But there still has been an important assumption in these methods, the isotropic volume change during the transfomrations. Recently, Jaramillo and Lusk [1] reported a non-isotropic dilatation during a cyclic heat treatment without externally applied stress. They suggested that the origin of this phenomenon might be the transformation induced plasticity (TRIP) caused by thermal stress. In order to investigate the effect of thermal stress on the dilatation, dilatometric experiments with various heating rates were carried out for IF steel. The measured dilatations indicated that the anisotropic phenomena could be caused by thermal gradient in the specimen and transformation plasticity concerned with this gradient. In this study, we have simulated the dilatometric experiments by using finite element (FE) model coupled with transformation plasticity to validate the anisotropic phenomena in dilatometry. Through the FE simulation, the non-isotropic volume changes were successfully reproduced and the dilatometric anisotropy concerned with transformation plasticity could be analyzed.

Key Words : Dilatometry, Finite element method (FEM), Transformation plasticity, Anisotropy, Thermal gradient

참 고 문 헌

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