第５号様式

論文審査の要旨

博士の専攻分野の名称	博　士　（　工学　）	氏名	TRINH DUC TRUONG
学位授与の要件	学位規則第４条第[1]・２項該当		

論　文　題　目

Transformation-thermo-mechanical Analyses on Size Effect in Polycrystalline TRIP Steels based on Crystal Plasticity Finite Element Method

（結晶塑性有限要素法による多結晶 TRIP 鋼における寸法依存性の変態・熱・力学解析）

論文審査担当者

主　　査	准教授	岩本　剛	印
審査委員	教　授	山田　啓司	印
審査委員	教　授	菊植　亮	印
審査委員	准教授	河野　佑	印
審査委員	教　授	Eliot Fried	印
		（沖縄科学技術大学院大学）	

〔論文審査の要旨〕

This thesis discusses the length scale effect on the strain-induced martensitic transformation (SIMT) and the size-dependent plasticity caused by the mechanism of slip-initiated dislocation.

The thesis includes 5 chapters. First of all, the development of the numerical models for SIMT in TRIP steels as well as the length scale effect related to the dislocation motions were reviewed in Chapter 1.

In Chapter 2, a computational investigation of microstructure related to SIMT at a length scale of crystal with the formation of shear band structures in both single and polycrystal TRIP steel within the framework of finite strain was presented. The extended framework of the cellular automata approach based on the rate-dependent crystal plasticity finite element method (CPFEM) was provided. A two-dimensional unit cell with periodic boundary conditions (PBCs) for tension was applied to consider the infinite crystalline media. The dependence of the initial crystal orientation was shown. Additionally, the analysis on the length scale effects was shown by modifying the size of a crystal lattice in the monocrystal model and by comparisons of different numbers of grains formed by Voronoi tessellation in the polycrystal model.

In Chapter 3, in order to explain clearly the importance and complexity of plasticity due to the mechanism of dislocations, an investigation on the size-dependent crystal plasticity was done by developed the model from Chapter 2. The notion of microforce associated with a gradient of a kinematic descriptor was coupled within the CPFEM framework to introduce the size dependency induced by energies. A clear and

developed hardening coefficient accounting for size effects in CPFEM framework was presented. The analyses on deformation behaviors and formed microstructures of infinite crystal model of both single and polycrystal metastable austenitic steel were numerically presented. From the obtained results, multiple length scale effect including grain size dependence were discussed comprehensively.

Finally, in Chapter 4, the main findings, conclusions, and the required further works were described.

Findings of this research reveal that the basic features of SIMT and plasticity with the size effect in crystalline TRIP steel were described successfully by the developed numerical model for both a single crystal and a polycrystal model with different initial crystallographic orientations.

From the achievements noted above, the applicant Trinh Duc Truong has published 3 peer-reviewed papers in international journals and academic book. After carefully examined the results from presentation, dissertation, achievements, and the responses on the questions raised from the examiners, the committee agree that applicant passes the exam.

備考：審査の要旨は，1,500 字以内とする。