【Grant-in-Aid for Scientific Research (S)】
Science and Engineering (Engineering)

Title of Project : Quest for Fundamental Dynamics of Domain Homo Interface in Shape Change Materials and Principles for High Performance Materials

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Research Area : Materials science and engineering
Keyword : Structural and functional, shape change materials, domain homo interface

【Purpose and Background of the Research】

Shape change materials exhibit tunable functions in materials properties by changing the volume fraction of domains which are formed through solid-solid diffusionless phase transformation. The volume fraction control can be done by applying stress, magnetic and/or electric fields. The shape change materials are classified into shape memory alloy, magnetic shape memory alloy and piezoelectric materials. In order to acquire high performance materials, rapid growth of a favorable domain by applied field is needed and that can be achieved by easy motion of domain *homo* interface between domains. This mechanism is called "dynamics of domain *homo* interface" and in this project the fundamentals of the dynamics are pursued as well as principles of the development of high performance materials. Especially, the main problem to limit the lifetime of shape change materials is lattice defects introduced during the motion of interface. The main cause of defect formation is due to friction in interface motion. Then, another purpose is to solve this problem from the viewpoint of "twist" of domains at the interface. The mobility of interface must depend on phase stability and lattice softening. Based on the above, novel high-performance shape change materials will be innovated and developed for biomedical and energy fields.

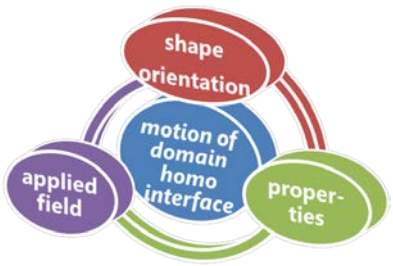

Figure 1　Materials function of shape change materials

【Research Methods】

1. Theoretical analysis of geometry at domain *homo* interface
2. Relationship between phase stability and geometry of domain *homo* interface
3. Experimental analysis of domain *homo* interface
4. Dynamics of domain *homo* interface
5. Principals for high performance materials and practical development

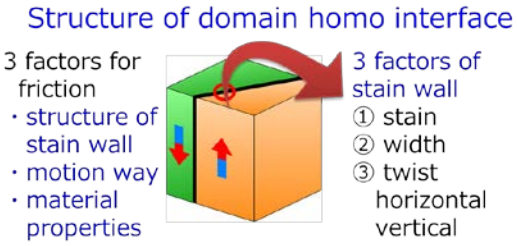

Figure 2　Factors related to domain *homo* interface

【Expected Research Achievements and Scientific Significance】

New theory of structure and dynamics of domain *homo* interface related to phase stability and lattice softening as well as novel material design principles will be established in addition to practical development of shape change materials in both biomedical and energy fields.

【Publications Relevant to the Project】

・T. Inamura, H. Hosoda and S. Miyazaki: Incompatibility and preferred morphology in the self-accommodation microstructure of β-titanium shape memory alloy, *Phil. Mag.*, 93 (2013) pp.618-634.
・T. Inamura and H. Hosoda: Crystallography of Martensite in TiAu Shape Memory Alloy, *Metallurgical and Materials Transactions A*, 42A (2011) 111-120.

【Term of Project】 FY2014-2018

【Budget Allocation】 140,000 Thousand Yen

【Homepage Address and Other Contact Information】

http://www.mater.pi.titech.ac.jp