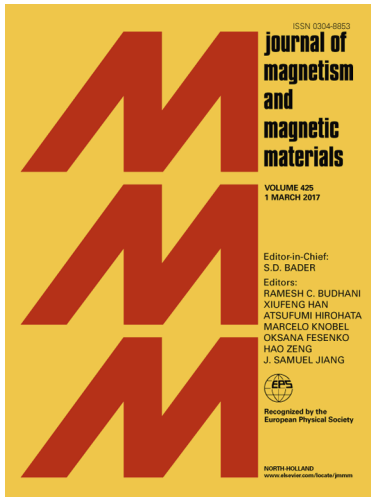

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Dynamic Magnetic Shape Memory Alloys Responses: Eddy Current Effect and Joule Heating

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Key Words: *MSMA, variant reorientation, dynamic responses, eddy current, Joule heating*

ABSTRACT

Generating high actuation frequency ($\sim 1.0kHz$) is one of the potential applications of Magnetic Shape Memory Alloys (MSMAs). In this work, dynamic responses of single crystal MSMAs due to variant reorientation are investigated. Time dependent part of the Maxwell equations becomes significant for a high frequency regime. Generation of an electric field and magnetic flux linkage due to the motion of the material points during deformation create a complex electro-magneto-mechanical coupling mechanism. We perform a thermodynamically consistent study to capture the variation of electromagnetic fields due to the deformation in the presence of fluctuating magnetic field, mainly focusing on eddy current and Joule heating. A comparison of MSMA responses with a typical ferromagnet/magnetostrictive material responses is discussed.

1 Introduction

MSMAs are best known for their unique ability to produce Magnetic Field Induced Strains (MFIS) up to 10% under a magnetic field [1–4]. Some of the commonly used MSMA material systems are NiMnGa [5–10], FePd [11–15]

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