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NON-EQUILIBRIUM THERMODYNAMICS FRAMEWORK FOR DISLOCATIONS IN SEMICONDUCTOR CRYSTALS AND SUPERLATTICES *

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Dedicated to Professor Mihail Megan
on the occasion of his 70th anniversary

Abstract

In the framework of the extended irreversible thermodynamics with internal variables a model for semiconductor crystals and superlattices with dislocations is proposed in order to study the thermal, electrical and mechanical properties of these materials. In the linear approximation, constitutive equations, rate equations for the heat flux and the internal variables are derived. A new dislocation tensor is defined to describe the geometry of these defect lines, because their relative orientation with respect to the superlattice interfaces is very relevant This implies cumbersone equations, but we focus our attention on their general conceptual features. The obtained results may have relevance for miniaturized semiconductor lasers and optimized thermoelectric devices and in other technological sectors.

1 Introduction

The behaviour of dislocations in semiconductor superlattices is one of the frontiers in the so called "dislocation engineering", with practical conse-

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