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The Effects of Active Multi-Slip Continuum Dislocation in the MDCM using Meso-Scale Analysis

Temesgen Takele Kasa[1*], Tafesse Gebersenbet[2]
[1]Mechanical Engineering , State university of New york-Erie Community college , Buffalo NY, USA
[2]1Mechanical Engineering, Saint Marry Univesity 2, Austin-Texas, USA
*e-mail address ttkh1@pukyong.ac.kr/kasa@ecc.edu

ABSTRACT

The key purpose of this paper is to propose a multi-slip-dependent continuum dislocation method for matrix-dominated composite structure (MDCS) analysis. The methodology focuses on dissipation energy theories utilizing a meso-scale integrated with small-strain kinematics. The mathematical modeling of the CDM comprises active multi-slip system formulations, thermodynamic dislocation analysis (TDA), free energy dissipation analysis, and the progression of dislocations. Furthermore, zero and non-zero energy dissipation due to dislocation progression is formulated by using an energy minimization technique with variational calculus. The numerical analysis, performed with analytical software, is presented using zero and non-zero energy dissipation energy formulations. The outcomes indicate that the formulated approach can be effective for obtaining optimal analysis results for matrix-dominated composite (MDC) materials with a mono-slip system. In sum, this study confirms the feasibility of using the proposed approach to investigate MDCS with inclusions.

Keywords: Multi-slip; Meso-scale; CDM; active slip; TDA; MDCS