ACOUSTIC EMISSION FROM FAST DISLOCATIONS IN 3D BCC IRON CRYSTALS

Petr Hora*, Anna Machová, Jan Červ and Alena Uhnáková

Institute of Thermomechanics AS CR, v.v.i., Prague, Czech Republic;
e-mail: hora@cdm.it.cas.cz, machova@it.cas.cz, cerv@it.cas.cz, uhnakova@it.cas.cz

Keywords: acoustic emission, dislocations, molecular dynamics

Acoustic emission and kinetics of dislocations emitted from a crack is studied via molecular dynamics (MD) utilizing nonlinear interatomic forces, [1] and [2]. 3D results indicate that edge dislocation segments in the middle of the crystal at the free sample surface can accelerate. The dislocations in MD penetrate the free surface in transonic or supersonic regime. Possible sources for such behaviour are discussed in the framework of continuum models. MD results comply with recent continuum analysis [3] of surface waves in anisotropic medium where supersonic regime of wave propagation at the free surface can exist unlike isotropic continuum.

Acknowledgement

The work was supported by the Institute Research Program RVO: 61388998 and by the projects of the Czech Science Foundation GACR 17-22615S and GACR 17-12925S. The work of P. Hora was supported by the European Regional Development Fund under Grant No.CZ.02.1.01/0.0/0.0/15_003/0000493 (Centre of Excellence for Nonlinear Dynamic Behavior of Advanced Materials in Engineering).

References

[1] G.J. Ackland, D.J. Bacon, A.F. Calder and T. Harry. Computer simulation of point defect properties in dilute Fe-Cu alloy using a many-body interatomic potencial. *Phil. Mag. A*, **75**: 713–732, 1997.

[2] A. Machová and G.J. Ackland. Dynamic overshoot in α-iron by atomic simulations. *Modelling Simul. Mater. Sci. Eng.*, **6**: 521–542, 1998.

[3] N. Favretto-Cristini, V. Komaditich, J. Garcione and F. Cavallini. Elastic surface waves in crystals, Part 1: Review of the Physics. *Ultrasonics*, **51**: 653–660, 2011.