Force elastic fields of local microdefects in strained polymers and composites based on them

A.A. Valishin¹, T.S. Mironova²

¹ Bauman Moscow State Technical University, Moscow, 105005, Russia

² Lomonosov Moscow State University of Fine Chemical Technologies, Moscow, 119571, Russia

The article describes the mechanism of the elastic interaction between local microdefects, called holes, which are formed and accumulated in the area of forced elasticity in front of the crack fracture in polymers. We calculated the elastic fields of holes, their own elastic energy, interaction energy of holes and the strength of their pair interaction. It is shown that the interaction between the holes leads to the fact that each hole is surrounded by a cluster of smaller holes.

Keywords: elastic fields, local microcracks, strained polymers and composites.

REFERENCES

- [1] Dimitrienko Yu.I., Sokolov A.P. *Inzhenernyi zhurnal: nauka i innovatsii Engineering Journal: Science and Innovation*, 2013, iss. 1. Available at: http://engjournal.ru/catalog/mathmodel/ material/427.html
- [2] Dimitrienko Yu.I., Sokolov A.P. Matematicheskoe Modelirovanie Mathematical Models and Computer Simulations, 2012, vol. 24, no. 5, pp. 3– 20.
- [3] Dimitrienko Yu.I., Sokolov A.P. Elastic properties of composite materials. *Mathematical Models and Computer Simulations*, 2010, vol. 2, no. 1, pp. 116–130.
- [4] Dimitrienko Yu.I. Thermal stresses and heat mass-transfer in ablating composite materials. *International Journal of Heat Mass Transfer*, 1995, vol. 38, no. 1, pp. 139–146.
- [5] Dimitrienko Yu.I. Thermal Stresses in Ablative Composite Thin-Walled Structures under Intensive Heat Flows. *International Journal of Engineering Science*, 1997, vol. 35, no. 1, pp. 15–31.
- [6] Valishin A.A., Stepanov T.S. *Inzhenernyi zhurnal: nauka i innovatsii Engineering Journal: Science and Innovation*, 2012, iss. 2. Available at: http://engjournal.ru/articles/52/52.pdf.
- [7] Valishin A.A., Mironova T.S. *Inzhenernyi zhurnal: nauka i innovatsii Engineering Journal: Science and Innovation*, 2013, iss. 9(21). Available at: http://engjournal.ru/articles/1119/1119.pdf
- [8] Looyehl M.R.E., Samanta A., Jihan S., McConnachie. Modeling of reinforced polymer composites subject to thermo-mechanical loading. *International Journal for Numerical Methods in Engineering*, 2005, vol. 63, no. 6, pp. 898– 925.
- [9] MeManns H.N., Springer G.S. High temperature thermomechanical behavior of carbon-phenolic composites: I Analysis, II Results. J. Composite Materials, 1992, vol. 26, pp. 206–255.
- [10] Baia Yu, Valleea Till, Keller Thomas. Modeling of thermal responses for FRP composites under elevated and high temperatures. *Composites Science and Technology*, 2008, vol. 68, no. 1, pp. 47–56.

- [11] Dimitrienko Yu.I. *Nelineinaya mekhanika sploshnoy sredy* [Nonlinear Continuum Mechanics]. Moscow, Fizmatlit, 2009, 624 p.
- [12] Landau L.D., Lifshits E.M. Theory of elasticity. Moscow, Nauka Publ., 1978, 358 p.
- [13] Dimitrienko Yu.I., Kashkarov A.I. Vestnik MGTU im. N.E. Baumana Herald of the Bauman Moscow State Technical University. Series: Natural sciences. 2002, no. 2, pp. 95–108.
- [14] Teodosiu K. Uprugie modeli defektov v kristalakh [Elastic models of defects in crystals]. Moscow, Mir Publ., 1985, 352 p.
- [15] Kosevich A.M. Osnovy mekhaniki kristallicheskoy reshetki [Fundamentals of mechanics of the crystal lattice]. Moscow, Nauka Publ., 1972, 203 p.

Valishin A.A. (b. 1940) graduated from Lenin Moscow State Pedagogical institute in 1963 and Lomonosov Moscow State University in 1968. Dr. Sci. (Phys.&Math.), Professor of the Computational Mathematics and Mathematical Physics Department at Bauman Moscow State Technical University, Professor of the Higher and Applied Mathematic Department at Lomonosov Moscow State University of Fine Chemical Technologies. He is the author of more than 100 studies in the field of theory of destruction, application of probability theory and mathematical statistics. e-mail: enf@mail.ru

Mironova T.S. (b. 1987) graduated from Lomonosov Moscow State University in 2010 Sphere of research: application of probability theory and mathematical statistics to chemical and technological processes.