Self-similar response of condensed matter under intensive loading

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The use of shock-wave loading and high-time resolution recording systems provide a unique opportunity to develop methods for studying structural relaxation mechanisms and the patterns of momentum transfer caused by them. An experimental study of the strength and rheological properties of a number of liquids (polar and nonpolar) and solids (ceramics), used and found in various branches of engineering and industry, over a wide range of strain rate. We present the results of the analysis of relaxation mechanisms in the study of the velocity profiles of the free surface of liquids subjected to shock-wave loading by the electric explosion of wire (EEW) and using the explosive generator method (EG), implemented on the basis of the institutes of ICMM UB RAS (Perm) and FRC PCP MC RAS (Chernogolovka) [1] and [2]. The results of the analysis of the statistics of fragmentation of ceramic samples obtained as a result of their destruction under the action of EEW are presented [3]. The established regularities of rheological behavior and destruction of liquids reveal signs of self-similarity, which are also characteristic of the behavior of solids (the power-law universality of the quasi-plastic front, the dependence of the deflection strength, the asymptotics of viscosity), allow us to establish the relationship of structural relaxation mechanisms with the peculiarities of the formation of wave fronts in liquids. The research was supported by a grant Russian Science Foundation, project No. 21–79–30041.

[1] Bannikova I, Uvarov S, Zubareva A, Utkin A and Naimark O 2016 *J. of Phys.: Conf. Ser.* **774** 012051

[2] Bannikova I, Zubareva A and Utkin A 2018 *Tech. Phys.* **68** 498–505

[3] Bannikova I, Uvarov S and Naimark O 2016 *Proc. Str. Int.* **2** 1944—1950