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A COMMENTARY TO V. V. NEVEROV'S ARTICLE "MASS TRANSFER BY A DILATATION FIELD OF INCOMPLETE SHEAR"

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The article in question is dedicated to the analysis of mass transfer due to plastic deformation of inhomogeneous solids. As a basis for the concept presented, the author uses the notions of "incomplete shear" and "a structure of a new type" as opposed to "rigid complete shear" and "a structure of nonuniform pressure and density," respectively. I cannot see any novelty in the notions themselves, inasmuch as rigid shear, the way it is described in the article, seems to be nothing but joint plastic distortion, whereas incomplete shear is simply a disjoint plastic distortion. The presence of the latter means, in turn, that a finite density of dislocations (surely, a dislocation is nothing but an incomplete shear) has been introduced into the medium. It is also obvious that incomplete shear (i.e., a dislocation) creates around itself a nonuniform stress field which, no doubt, can be called a structure of nonuniform pressure and density, but this adds nothing to our knowledge of dislocations.

At the same time, the idea of considering a dislocation — the well-known structure in the theory of plasticity — from the standpoint of incomplete shear makes sense. Although, from a purely kinematic point of view, the relationship between any plastic shear and the stress distribution formed in the medium has been studied, the modern theory of plasticity tends to explain everything on the basis of elementary (lattice) dislocations, whereas experimental data of the last decade indicate the primary role of mesoscopic rather than microscopic structural level in plasticity processes (see [1], for example). Thus, it is well known [2] that plastic deformation proceeds through formation of shear zones in which many tens or hundreds of single dislocations are concentrated. But as a result of the formation of a shear zone, one part of the material is shifted relative to the other by tens (hundreds) of interatomic distances. A natural question arises: Would not it be more correct to describe plastic-deformation processes in terms of motions of the structural elements of the medium as a whole rather than in terms of dislocations? An example of realization of this idea can be found in [3]. From this standpoint, the concept developed by V. V. Neverov, which is mostly of a mesoscopic character, is justified and useful.

In the sections "Model of Incomplete Shear in a Continuum" and "Model of Incomplete Shear in an Atomic Medium," the author solves, using Muskhelishvili's method, the plane problems of distribution of displacements and stresses in an elastic medium with a cut whose edges can slip relative to each other. A model is considered that actually assumes that a body is plastically deformable along some plane regions of limited length and retains its elastic properties in the gaps between these regions. In the slippage (cut) regions, the edges of the cut interact through the forces of viscous or dry friction. The nonuniformity of plastic deformation is responsible for the occurrence of internal stresses, which, in turn, influence the friction forces acting between the edges and lead to the strain-hardening effect.

This approach to the strain-hardening effect and to plastic deformation on the whole is certainly new and deserves further development.

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