THE INFLUENCE OF ANISOTROPIC MICRODAMAGE NUCLEATION ON MACRODAMAGE EVOLUTION UNDER EXTREME STRAIN RATES REGIME

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Abstract: The microdamage anisotropy in metals and its influence on macrodamage under extreme strain rates regime is under consideration. We distinguish two levels of macrodamage approximation by a constitutive model: global and local [5]. We have good global damage approximation (GDA) if (global) strain-stress curves from experiment and mathematical model are close to each other. We have good local damage approximation (LDA) if apart from the global we have particularly good coincidence in: macrodamage initiation time, velocity of macrodamage evolution and the geometry of macrodamage pattern.

The GDA can be covered by scalar damage models, while LDA needs higher order tensor in the model describing damage [1,6]. It should be noted, however, that for practical applications scalar damage models are still the most popular ones. It is due to the fact, that the identification of the material functions and parameters (necessary for industrial applications) for models with higher order tensor describing damage, as we claim, are still on the level of scientific considerations [2,3].

It is experimentally proved that microdamage nucleation has no significant influence on global material response under extreme strain rates regime in metals [4]. Hence, from the point of view mathematical description, it should be understood as weak influence of GDA. Nevertheless, its role in obtaining good LDA can be important. This paper aims to present preliminary results on the mathematical (numerical) level, showing that anisotropic microdamage nucleation can play crucial role in macrodamage evolution.

Keywords: microdamage nucleation, anisotropy, constitutive modelling

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References


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