Calculation Hierarchy Model of Dynamic Metals Failure Process

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Summary: Functional correlations for a dynamic invariant *I*, centers formation rate *J* were input for 2D mathematical calculation codes, what allowed description of explosion experience on uranium failure and experiences on action of pulses of relativistic electron beams to the thin foils of a number of metals.

Introduction

Earlier we demonstrated that in dynamic metals failure phenomenon the developing dissipative structures having a fractal nature on different time-scale levels resisted to external action. At that failure centers cascade on the threshold of macro-failure changing the body continuity is a percolation cluster [1].

Results and Discussion

There have been specified time-temperature regularities of the dynamic failure process of a number of metals and a dynamic invariant $I(E_{cr})$, which bonds the energy E_{cr}, spent for failure, with energy parameters of crystal lattice. The dynamic invariant has close values for all studied metals, in terms of this invariant the centers formation rate *J* is expressed. The time dependence of centers formation rate, specifying the time bound of preserving functional properties, has an exponential form $J(t) \sim (t - t_p)^{-g}$, t_p – longevity, which depends on the external pressure amplitude [4].

Functional correlations for *I, J* were input for 2D mathematical calculation codes, what allowed description of explosion experience on uranium failure [5] and experiences on action of pulses of relativistic electron beams to the thin foils of a number of metals.

Conclusions

The unique mechanism of dynamic failure process – loss of body continuity through clustering of failure centers cascade, – unique order parameter (final density *N* of failure centers), and unique dimension of space, where the process goes, specifies the possibility of building an adequate calculation model of dynamic failure process as well as the possibility of forecasting metals behavior under extreme conditions.

References

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