A03: Viscoplasticity effect during impact of metallic foams

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In the last 20 years, a new rapidly developing method is applied to calculations of solid mechanics problems, [1]. It is a non-local method. The predecessors of the method that have been applied to crystals were developed in [2] and [3]. In the presentation, we show an application of the method for the evaluation of the viscoplasticity effects [4, 5] in the copper foams. The oxygen free high conductivity copper (OHFC) can be applied to produce the open-cell multifunctional structures, for example, heat exchangers, heat capacitors, using additive manufacturing [6]. We use the highly parallelized program Peridigm for the analysis, [7].

Figure 1(a) shows an exemplary impacting foam sample attacking with a velocity of 20 m/s an elastic block. The highest plastic strains are in the case of ideally elastic-plastic case (b). The equivalent plastic strains are higher when neglecting the strain rate hardening effects (d) than including both strain hardening and strain rate hardening effects (c). We provide dependences of the equivalent plastic strains on impact velocities and strain rate hardening exponents.

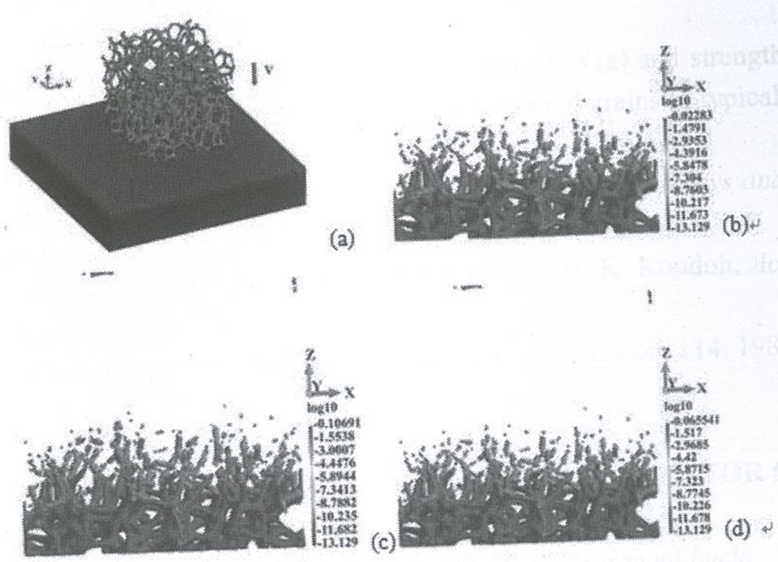

Fig 1. The analysed system (a) and equivalent plastic strain distribution: material ideally elastic plastic (b), elastic-plastic with strain hardening and strain rate hardening (c), elastic-plastic with strain hardening (d).

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A04: Molecular motion of poly(alkyl methacrylate) chain in ultra-thin films studied by quantum beam techniques

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Polymeric materials are often used in a form of thin film such as food wrap and surface coating. In such the applications, polymer films thinner than 100 nm have been often used. The thickness of such the ultra-thin film is less than the unperturbed size of a polymer chain; therefore, the polymer chain in an ultra-thin film is strongly constrained. However, the details on the constrained dynamics of polymer molecules in ultra-thin films is still unclear. In the current study, the dynamics of the polymer chains was investigated by quantum beams: neutron and laser. Neutron reflectometry (NR) provides the structure information in the depth direction on the thin film with the sub-nanometric spatial resolution. On the other hand, super-resolution laser microscopy (SRM) enables the lateral information with the spatial resolution of 10 nm. The diffusion dynamics of polymer chains during the thermal and solvent vapor annealing processes was studied by the NR analysis for the deuterium-labeled polymer and the SRM for the fluorescence-labeled sample. The NR and SRM revealed the characteristic dynamics in thin films.