

Mechanisms of strain rate effect of metal foams with numerical simulations of 3D Voronoi foams during SHPB tests

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Abstract: Metal foams were usually prepared and tested as light-weight and efficient energy absorption materials. Controversial results among different tests and numerical simulations show that the mechanisms of strain rate effect of metal foams are not clear yet. To study the main mechanisms of strain rate effect of metal foams during split Hopkinson pressure bar (SHPB) tests, numerical simulations were carried out by FEM, in which metal foams were simulated with 3D Voronoi models. In these simulations, the matrix material of metal foams is assumed to have no strain rate sensitivity, which helps to determine the strain rate effect of metal foams clearly. The numerical simulations show that metal foams' specimens still exist some strain rate sensitivity even the matrix material without strain rate sensitivity. Further quantitative analysis reveals that effects of inertia and localized deformation of metal foams are two main causes to induce the strain rate sensitivity of metal foams.

Key word: Metal foams, Strain rate effect, Inertia, Localized deformation, 3D Voronoi model