Determination of the forming limit diagram of the multilayer sandwich plates with numerical simulation of the Nakazima test

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Determination of the forming limit diagram for multilayer sandwich plates based on the numerical simulations of the Nakazima test is the overall goal of the research [1]. The numerical identification of critical conditions during deformation is based on the evaluation of the major principal strain values and their first and second-time derivatives [2] calculated during finite element analysis. The strain localization is determined by the maximum of strain acceleration which corresponds to the inflection point of the strain velocity versus time. The limit strains are selected for different specimens, according to the Nakazima test setup, undergoing deformation at different strain paths covering the entire range of the strain paths typical for sheet forming processes. The developed finite element model is based on the explicit formulation, J2 plasticity and Johnson-Cook hardening model. The computational domain is discretized with the shell elements. Such an approach is then used to evaluate differences in the FLD diagram between the sheets of titanium (Ti), aluminium (Al) and Armco, as well as, their combination obtained by explosive welding. The investigated sandwich sheet is composed of five layers arranged as Ti-Al-Armco-Al-Ti (Fig. 1). The synergic effects of the interacting materials under various deformation routes are also discussed during the research.

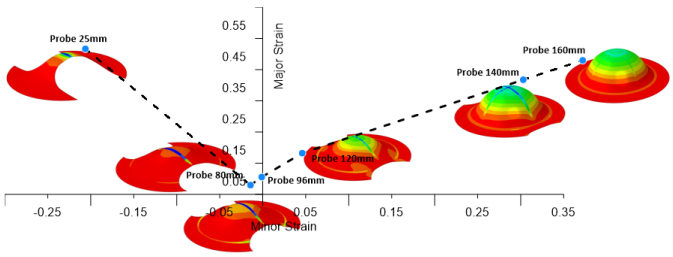

Fig. 1 Forming limit diagram for the multilayer sandwich Ti-Al-Armco-Al-Ti plate.

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