Experimental modelling of materials properties and microstructure of new high-strength steels for press-hardening

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Abstract:

Press-hardening is a highly dynamic process that involves rapid temperature changes. These process aspects play a major role in microstructural evolution and mechanical properties. In order to develop any thermomechanical processing sequence, including press-hardening, one needs materials models of the best possible accuracy, if relevant results are to be obtained from FEM methods employed for designing metalworking processes. Therefore, relevant data on materials behaviour under real process conditions must be obtained experimentally. In one such experiment, as described here, PHS 1800 and PHS 2000 low-alloy sheets of steel were subjected to thermal exposure identical to the heating sequence for press-hardening, including the removal from the furnace and transfer to the tool. Heat treatment sequences were proposed which correspond to the thermal profiles in the actual process. The results were input into FE simulations of press-hardening. In the low-alloy steels, the selected heat treatment sequence led to strengths of more than 2000 MPa and elongation levels of approx. 9%.

Key words:

press-hardening, PHS 1800, PHS 2000, material-technological modelling