



Subarea POB3: Materials for the future. Ultralight and highly resistant materials in automotive industry.

Title of the presentation: Advanced technologies of forming drawpieces of heat-resistant and creep-resistant nickel superalloys.

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Abstract:

As part of the research on the deformability of nickel superalloys, carried out at the Department of Advanced Materials and Technologies at the Faculty of Materials Science and Engineering of the Silesian University of Technology in Katowice, a series of analyzes were performed on the selection of alternative technologies for shaping these heat-resistant and creep-resistant alloys for aircraft and automotive structures. The wide spectrum of material tests performed for thin sheets of Inconel nickel superalloys allowed to define the basic characteristics of mechanical properties, structure and technological susceptibility of these highly resistant materials. The collected research results were used to fill in and extend the material models of nickel superalloys, necessary in numerical modeling of material deformability, and specifically sheet metal stamping. In the search for alternative methods of shaping nickel superalloys, a liquid shaping method was used - hydroforming. The basis for this method is the use of pressurized liquids in place of one of the rigid tools. This ensures reduction of friction, and thus obtaining greater deformability of the sheets. Hydroforming enables high-quality product surfaces to be obtained, without the need for additional processing, as well as very complex shapes of stamped products, which are difficult to produce or cannot be obtained by classic stamping methods. By applying techniques of numerical modeling and simulation of pressing processes, it is possible to use hydroforming for pressing nickel superalloys. As part of the search for the most effective methods of shaping nickel superalloys, a series of tests was carried out to simulate the processes of hydromechanical shaping of a selected drawpiece of an aircraft engine compressor cover - a cone (Fig. 1) made of Inconel 625 nickel superalloy. The obtained test results made this solution currently used in industrial practice and designing technologies using simulation techniques and material models is an industry standard procedure.



Fig. 1. Industrial drawpiece - aircraft engine compressor cover – a cone made of 0.45 mm thick steel sheet made of Inconel 625 alloy.