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Design and manufacturing of automotive parts with tailored mechanical properties

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ABSTRACT

With the high demand of automobile lightweight, high-strength lightweight materials, such as ultra high strength steel and aluminum alloy plate, are widely used in automotive industry. With enhanced strength, the automobile parts are also supposed to meet the requirements of impact energy absorption. The automobile parts with tailored mechanical properties can achieve a good match for the strength and impact performance. Therefore, it is significant to carry out the research on the design and manufacturing of tailored mechanical properties parts. In this paper, the optimal design and hot stamping of a B-pillar reinforcement panel with tailored mechanical properties were studied. Based on the FE analysis of vehicle side impact, the optimal design of mechanical property distribution was carried out for this part. The parts with tailored mechanical properties were hot stamped in the methods of die coating and partition temperature control and the forming mechanism were studied. With the application of reverse engineering technology, the influence law and mechanism of the tailored mechanical properties on the forming accuracy of the hot stamped parts were then analyzed. The results showed that (1) the optimal design of the structure parts with tailored mechanical properties can be realized based on the crash analysis. (2) The precise control of microstructures and mechanical properties of hot stamped parts can be achieved by of tailed hot stamping technology. (3) The tailored mechanical properties had a certain influence on the forming accuracy of the hot stamped parts.

KEYWORDS: tailored mechanical properties, optimal design, hot stamping, forming accuracy