

Wheel Hub Forging Process optimization using DOE Technique

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Abstract:

The study of micro-structure evolution during forging holds the key in controlling the material properties. The material flow during forging process along with the micro-structure evolution is studied using bulk metal forming software DEFORM 3D. Cellular Automata algorithm is used for micro-structure evolution and DOE technique is used for forging process optimization. Experimental validation is done by forging the Wheel Hub. Objective is to optimize forging process parameters to minimize die load and maximize yield. Initially, the billet size for Hub forging is 121.5mm in length and 56mm diameter, with 808 tons and 294 tons loads in blocker and finisher operation respectively. Based on die design modifications, by observing material flow, die loads and flash thickness, DOE Optimized billet size to 90 mm length and 60 mm diameter, After DOE Optimization with different DOE Variables like Billet Height, Billet Diameter, Forging Temperature, Flash thickness, observing 339 tons and 245 tons loads in blocker and finisher operation and with modified die design yield is improved by 14.8 %. DOE optimization results were compared with the experimental validation results, and a good agreement was obtained.