Int J Adv Manuf Technol (2014) 70:1463–1471
DOI 10.1007/s00170-013-5377-z

ORIGINAL ARTICLE

Flow-forming optimization based on hardness of flow-formed AISI321 tube using response surface method

N. A. Razani · Abdolhossein Jalali Aghchai · Bijan Mollaei Dariani

Received: 1 November 2010 / Accepted: 1 October 2013 / Published online: 23 October 2013

Abstract Flow forming is an advanced locally plastic deformation applied to manufacture seamless tubes with thin walls and high precision dimension. One of the important mechanical properties of flow-formed tubes is hardness. In this study, after preliminary experiments for definition of effective parameters, design of experiments (DOE) is utilized to determine the influence of the parameters such as rotational speed of mandrel, feed rate, and wall thickness reduction on the hardness of flow-formed AISI 321 steel tube. Under experimental results, a mathematical model comprising effective parameters is developed to predict the optimum hardness, using response surface methodology (RSM). RSM's Box–Behnken design is employed to specify the optimum condition caused to a minimum hardness at high optimum confidence level. The analyzed model revealed that the hardness increases with increasing of the mandrel speed and the depth of cut, and it decreases with decreasing of the feed rate. The new point of view is related to the fact that the high level of thickness reduction covers the efficiency of mandrel speed.

Keywords Flow forming · Hardness · RSM