Examination of Working Condition for Reducing Thickness Variation in Tube Drawing with Plug

Takashi Kuboki*, Shunsuke Tasaka* and Shohei Kajikawa*

* Department of Mechanical Engineering & Intelligent Systems
The University of Electro-Communications
1-5-1 Chofu Gaoka, Chofu-shi, Tokyo, 182-8585, Japan
e-mail: kuboki@mce.uec.ac.jp

ABSTRACT

This paper shows numerical examinations on appropriate working condition for reducing thickness variation in tube drawing with a plug. Drawing is a common and important process in tube manufacturing in the industry as it is located at the final stage of the process line, and thus it dominates the quality of the tube products. In particular, when a plug used, the tube quality is improved in terms of average value of thickness and tube-inner surface integrity. However, even the plug usage is not effective for reducing thickness variation, which has already appeared in the previous processes.

There are a few research works on the reduction of thickness variation. Foadian et al. proposed a unique drawing method for suppression of thickness variation, which applies a tilted die according to the thickness distribution in the cross section [1]. However, the thickness distribution should be known in advance for its application, and the tilted dies should cause bending of the drawn tube [2].

The present research carried out a series of analysis using the finite element method (FEM). The analysis investigated the effect of working condition on thickness distribution after drawing tubes with initial thickness distribution. As a result, it was notably revealed that application of dies with small cone angle below 5 degrees was prominently effective for homogenizing the thickness distribution. This effect was strengthen by employing tubes with larger diameters and thicker walls. Moreover, the mechanism of homogenizing the thickness distribution was also examined. The small cone angle affected the contact length at die approach, and the contact length at thinnest side became longer than that at the thickest side. The difference of the contact lengths equalized the thicknesses of the thinnest and thickest sides. The FEM also predicted the thickness variation should almost be zero under the optimum condition.

REFERENCES

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