

Fabrication of a ring groove on tube-inner surface by ironing from outer surface using displacement control of tube bottom end

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ABSTRACT

This paper presents a improving method in a press forming for transferring convex shapes of an inner plug projection onto the tube-inner surface by applying outer-die ironing from the tube-outer surface. A patent of the concept was submitted by some of authors [1]. The patent explains the concept of the press forming which fabricates ring grooves by transferring the plug projection shapes. The plug shrinks in a unique manner for ejection after forming [1].

A previous study by the authors explained basic behaviours of the method [2]. The previous study found that the concave shape was not perfectly formed and some “Non-filled-area” appeared around the upper and lower parts of the plug projection [2]. The study suggested that the “Non-filled-area” might be reduced by applying a reaction force on the tube-end surface. However, the effect was not verified [2].

This study tried to verify the effect of applying the reaction force on the tube-end surface by the finite element analysis (FEA) and experiment. The FEA showed reaction force was effective for reducing “Non-filled-area” in the former half of the process. However, the continuously applied reaction force expanded the “Non-filled-area” in the latter half of the forming. Therefore, the reaction force should be reduced in the middle of the process. The displacement control of the floor die was used for the control of the reaction force. The FEA showed the suitable amount of the reaction force and the optimum timing for reducing the force. The analytical results were verified by the experiment and the “Non-filled-area” was successfully reduced by the proposed method. (256 words)

REFERENCES

- [1] Yamauchi Engineering Co. Ltd., Work processing method, motor housing manufacturing method, punch set and work processing apparatus, JP-A-2017-189795 (P2017-189795A), 2017-10-19.
- [2] T. Ozawa, T. Kuboki, S. Kajikawa, A. Yamauchi, A. Gunji and K. Onishi, Fabrication of ring groove on inner surface of cylindrical blank by ironing from outer surface, *Procedia Manufacturing*, 15, (2018), pp. 899-906.