

# INFORMATION OF A DOCTORAL THESIS IN ENGINEERING

Name of PhD. candidate: **Bui Khac Khanh**

Name of thesis: **“Research on backward extrusion technology in high-strength low-alloy steel for manufacturing pressure pipes”.**

Specialization: Mechanical Engineering

Code No: 9520103

Full name of the scientific supervisor:

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**2. Dr. Vu Trung Tuyen**

Training institutions: National Research Institute of Mechanical Engineering –

Ministry of Industry and Trade

## SUMMARY OF NEW CONCLUSIONS IN THESIS

### 1. Scientific significance of thesis

- Research on application of theoretical basis of backward extrusion method in production of pressure tube-shaped details from high-strength low-alloy steel.
- Combine theoretical research with digital and experimental simulation in determining suitable working area of ratio  $(d/D)$ ,  $(H/D)$  on shaping process of details in backward extrusion.
- Investigate impact of ratio between inner diameter and outer diameter  $(d/D)$  and height with outer diameter  $(H/D)$  of pipe details to deformation degree  $(\varphi)$ , force  $(P)$ . Thereby, we can create working area and relation function between  $(d/D)$ ,  $(H/D)$  and  $\varphi$ ;  $P$ .
- Find distribution results of press and deformation in process of backward extrusion of alloy steel 30X3MΦ and find a suitable working area as a scientific basis for experimental process, ensuring deformation and shaping ability of details.
- Initially find organizational changes and improvement in mechanical properties of alloy steel 30X3MΦ after backward extrusion, meeting requirements of pressure pipe details.

### 2. Practical significance

- Research results of thesis contributes to development of mechanical working technology, being proactive in production of pressure pipe shaped details for civil and defense industries.
- Determine working area in accordance with ratio  $d/D = 0.77 \div 0.81$  and  $H/D \leq 3.6$  to improve efficiency in backward extrusion.

- Determining appropriate temperature for backward extrusion of hot alloy steel ( $T = 1200^{\circ}\text{C}$ ).
- Experimental results have successfully fabricated body shell of anti-tank rocket PG – 29 as basis of production of pressure pipes in Vietnam.
- Research results of thesis can be used as reference for teaching and research in field of mechanical working.

### **3. New contributions of the thesis**

- Build surveying method on impact of ratio  $(d/D)$  and  $(H/D)$  to deformation degree of force in backward extrusion of high-strength alloy steel. At the same time, determine suitable working area of ratio  $(d/D)$  and  $(H/D)$  to maximum average pressure and the highest degree of equivalent strain.
- Determine size of bridge radius  $(R)$  of workpiece face, instead of workpiece with conical hole as real production, reducing error rate in backward extrusion.
- Determine rules of stress and deformation distribution in backward extrusion, thereby building the deformation model of material during alloy steel backward extrusion.
- Build an experimental system according to domestic research and production conditions; actively produce pressure pipes made from domestic produced cast steel.

*Hanoi, June 24<sup>th</sup>, 2019*

**Supervisor group**

**Ph.Dcandidate**

**Dr. Nguyen Ha Tuan      Dr. Vu Trung Tuyen**

**Bui Khac Khanh**