Metal Forming Processes (ME5807)

Dr. Yogesh Kumar
Assistant Professor
Mechanical Engineering Department
National Instiute of Technology Patna
Bihar - 800 005, India
yogesh.me@nitp.ac.in

LECTURE NO. 3
11 September 2020

Friction in Metal Forming

- Friction in metal forming arises because of the close contact between the tool and work surfaces and the high pressures that drive the surfaces together in these operations.
- In most metal forming processes, friction is undesirable for the following reasons:
  1. Metal flow in the work is retarded.
  2. The forces and power to perform the operation are increased.
  3. Rapid wear of the tool occurs.
- Friction and tool wear are more severe in hot working.
- If the coefficient of friction becomes large enough, a condition known as *sticking* occurs.

sticking in metal working is the tendency for the two surfaces in relative motion to adhere to each other rather than slide.

Lubrication in Metal Forming

- Metalworking lubricants are applied to tool-work interface in many forming operations to reduce harmful effects of friction.
- Benefits obtained from the application of lubricants are:
  1. Reduced sticking, forces, power, tool wear
  2. Better surface finish
  3. Removes heat from the tooling
- Consideration in choosing an appropriate metalworking lubricant include:
  1. Type of forming process (rolling, forging, drawing, etc.)
  2. Hot working or cold working
  3. Work material
  4. Chemical reactivity with tool and work metals
  5. Ease of application
  6. Cost

Numerical Problems – Problem No. 1

A metal is deformed in a tension test into its plastic region. The original specimen had $l_o = 50mm$ and $A_o = 322.6mm^2$.

At one point in the tensile test, the gage length $l_1 = 63.5mm$ and the corresponding engineering stress $\sigma_{n1} = 172.5MPa$; at another point, the tensile test prior to necking, the gage length $l_2 = 78.5mm$ and the corresponding engineering stress $\sigma_{n2} = 193MPa$.

Determine the strength coefficient K and strain- hardening exponent n.

Thank You