BMM3643 Manufacturing Processes
Sheet Metal Forming Processes

Individual Assignment 5

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Individual Assignment 5 - Sheet Metal Forming Processes

- Aims
  - Understand the characteristics of sheet metals and formability
  - Able to analyze the characteristics of sheet metal forming processes

- Expected Outcomes
  - Understand and able to calculate force in sheet metal forming processes

Example 1: Punch and die force

1. Estimate the force required for punching a 25 mm diameter hole through a 3.2 mm thick annealed titanium alloy Ti-6Al-4V sheet at room temperature.

Solution:

Punch force, $F = 0.7TL(\text{UTS})$

Refer to Table 6.10 Properties and Typical Applications of Selection Wrought Titanium Alloys at Various Temperature.

Properties and Typical Applications of Selected Wrought Titanium Alloys at Various Temperatures

Nominal composition (%)	UNS	Condition	Ultimate tensile strength (MPa)	Yield strength (MPa)	Elongation (%)	Reduction of area (%)	Temp. (°C)	Ultiamte tensile strength (MPa)	Yield strength (MPa)
99.5 Ti	R50250	Annealed	330	240	30	55	300	150	95
5 Al, 2.5 Sn	R545200	Annealed	860	810	16	40	300	565	450
6 Al, 4V	R56400	Annealed	1000	925	14	30	300	725	650
		Solution + age	1175	1100	10	20	300	980	900

Example 1: Punch and die force (continue)

Solution:

$$F = 0.7TL(\text{UTS})$$

$$F = 0.7(3.2)(\pi)(25)(1000)$$

$$F = \underline{\underline{0.18MN}}$$

Example 2: Deep drawability

1. Calculate R_{avg} for a metal where the R values for the 0^o, 45^o, and 90^o directions are 0.9, 1.6, and 1.75, respectively. What is the limiting drawing ratio (LDR) for this material?

Solution:

$R = (R_o + 2R_45 + R_{90})/4$

$= (0.9 + 3.2 + 1.75)/4$

$= \underline{1.46}$

Individual Assignment 5

1. What is springback in sheet-metal bending?
2. What is the force required to punch a square hole 50 mm on each side in a 0.1 mm-thick 5052-O aluminum sheet by using at dies? What would be your answer if beveled dies are used?
3. Estimate the force required for punching an oblong hole of 40mm width by 10 mm height through a 1.6 mm thick annealed titanium alloy 99.5 sheet at room temperature.

Individual Assignment 5 Format

Please remember to **include the questions** given in the assignments. **Cover page** of the assignment should include:

1. Your Name & No. Matric
2. Section
3. Lecturer's Name
4. Submission date

Late submission also will be penalized.