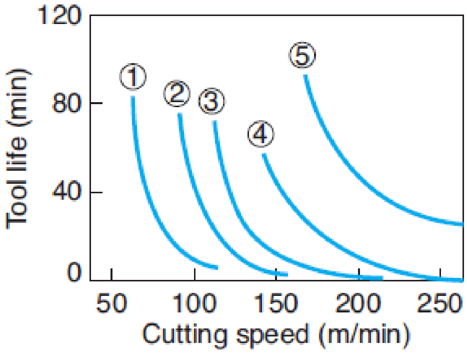
IE-352
Section 1, CRN: 32997
Section 2, CRN: 5022
Second Semester 1431-32 H (Spring-2011) – 4(4,1,1)
MANUFACTURING PROCESSES - 2

Thursday, May 12, 2011 (9/6/1432H)

Exercise: Cutting Speed and Material Removal

Name:	Student Number: 42

Effect of Cutting Speed and Material Removal



		Hardness (HB)	Ferrite	Pearlite
①	As cast	265	20%	80%
②	As cast	215	40	60
③	As cast	207	60	40
④	Annealed	183	97	3
⑤	Annealed	170	100	—

Consider the figure above showing the effect of workpiece hardness and microstructure on tool life in turning ductile cast iron. Assuming that a workpiece is cast at 265 HB, calculate the reduction in the quantity and percentage of material removed during the total tool life when the cutting speed in increased from 60 to 120 $\frac{m}{min}$.

Given:

(1) condition in the tool life vs. *V* graph

$V_1 = 60\ \frac{m}{min}$

$V_2 = 120\ \frac{m}{min}$

Req:

a) Material cut during life of tool #1 – material cut during life of tool #2,

i.e. $mat_1 - mat_2$

b) %ge *decrease* in material cut,

i.e. $\frac{mat_1 - mat_2}{mat_1} * 100$

Solution:

a) From graph (left)

At $V_1 = 60\ \frac{m}{min}$ ⇒ tool life ≈ 40 min (by using interpolation) ⇒

$\Rightarrow mat_1 = 60\ \frac{m}{min} * 40\ min = 2400\ m$

At $V_2 = 120\ \frac{m}{min}$ ⇒ tool life ≈ 5 min ⇒

$\Rightarrow mat_2 = 120\ \frac{m}{min} * 5\ min = 600\ m$

$\Rightarrow \boldsymbol{mat_1 - mat_2} = 2400\ m - 600\ m = \mathbf{1800\ m}$

b) $\Rightarrow \frac{mat_1 - mat_2}{mat_1} * 100 = \frac{1800}{2400} * 100 = 75\%$

i.e. ***doubling* cutting speed** results in **reducing 75% of material cut**

- Note that it is apparent from this exercise that **decreasing cutting speed** results in **more material removed** between tool changes.
- However, also note that as **cutting speed is reduced**, a **longer machining time** is required for the same operation, which has an **adverse economic impact** (since more energy is consumed).