

## 國立台灣科技大學九十九學年度碩士班招生試題

系所組別：機械工程系碩士班戊組

科 目：材料原理

(總分為100分)

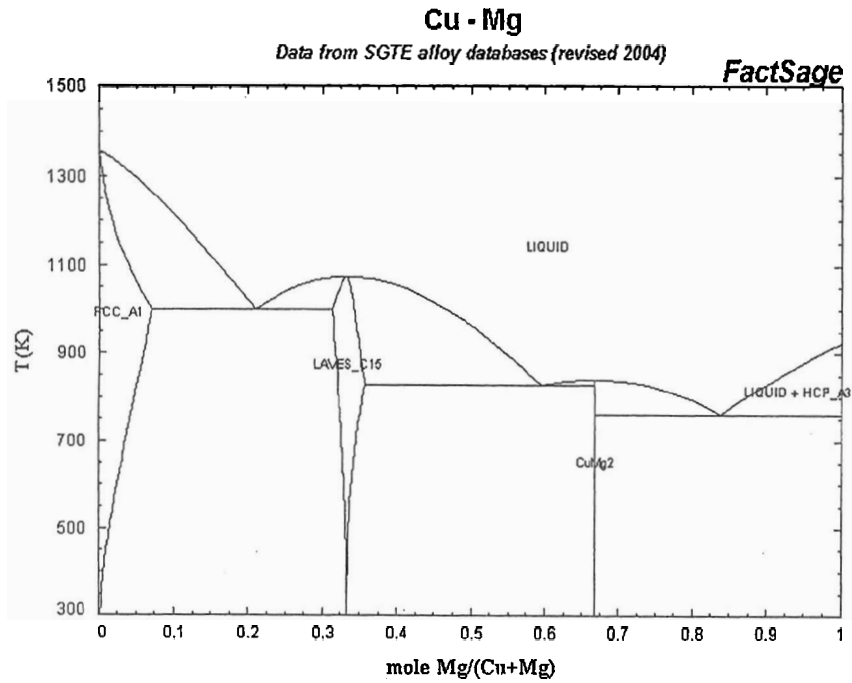
1. 琉璃工坊已設計好一件觀音菩薩的 3-D 設計圖，如果要打樣製造一尊觀音琉璃佛像，請問如何製造較迅速且便宜? (5%) 如果要大量生產一萬尊觀音琉璃佛像，請問如何製造較合宜? (5%) 請以流程圖說明過程及選擇此製程的原因。
2. 打鐵店在打造一件寶劍時有哪些主要程序? (5%)這些程序中有哪些因素會影響這把寶劍的性能? (5%)
3. 以能量轉換觀點配合圖示，說明(1)發光二極體 及 (2)太陽能電池之光電效應過程。(5%) 同時並以類似化學反應公式的方式說明能量轉換過程前後能量存在之形式。(5%)
4. 在金屬板上塗上一層玻璃釉料粉末，並進行高溫處理使釉料黏附在金屬板上，然而在製造過程中常見到釉料處產生巨大裂縫，形成此裂縫之原因為何?(5%)如何在材料選擇與製程上降低裂縫之產生?(5%)
5.  $ZrO_2-8mol\%Y_2O_3$  在某個溫度範圍是全離子導體，因此是常見燃料電池的電解質材料，它利用添加  $Y_2O_3$  至  $ZrO_2$  晶格中形成氧空孔，進行氧離子的擴散。若僅考慮此電解質的結構尺寸與使用條件，你要如何提高燃料電池的燃燒速率?(10%)
6. Sodium has a body-centered cubic structure. Its atomic radius is 0.1858 nm and its atomic mass is 22.99 g/mol. Show its theoretical density in  $g/cm^3$ . (10%)
7. Please show the differences between intrinsic semiconducting Si and extrinsic semiconducting Si, in terms of purity, electrical conductivity, and temperature effect on electrical conductivity. (10%)
8. Please compare the differences in density and gas tightness of aluminum, glass, and polyethylene, in terms of constituting atoms, bonding type, and atomic arrangement. (10%)
9. A copper alloy of Cu-10mol%Mg is melted at 1500K, and then very slowly cooled to room temperature. Describe the development of phases. Please show your answers by indicating the phase transformation temperatures and the phase reactions. (10%) The Cu-Mg phase diagram is shown in next page.



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10. What the main reasons causing the rise in temperature of soft magnetic materials?  
(4%) Which of the following soft magnetic materials you will choose for the applications as a motor operated at 60 Hz? (3%) Which of the following soft magnetic materials you will choose for the applications as a magnetic induction core operated at 100k Hz? (3%) Please show your picks along with your reasons.

Name	Composition	Permeability ( $\mu_r$ )		Coercivity ( $H_c$ ) ( $A \cdot m^{-1}$ )	Retentivity ( $B_r$ ) (T)	$B_{max}$ (T)	Resistivity ( $\mu\Omega \cdot m$ )
		Initial	Maximum				
Silicon iron,	Fe-3% Si	270	8000	60		2.01	0.47
Metglas <sup>a</sup> 2650S-2	$Be_{78}B_{13}S_9$		600,000	2	1.35	1.56	1.37
MnZn Ferrite	H5C2 <sup>b</sup>	10,000		7	0.09	0.40	$1.5 \times 10^5$
MnZn Ferrite	H5E <sup>b</sup>	18,000		3	0.12	0.44	$5 \times 10^4$
NiZn Ferrite	K5 <sup>b</sup>	290		80	0.25	0.33	$2 \times 10^{12}$

