

一、解釋下列各名詞：

- a). Thermosetting polymer: (4%)
- b). Nanomaterials: (4%)
- c). Hall-Petch effect: (4%)
- d). Creep: (4%)
- e). Sintering: (4%)

二、試說明 polymer 之凝聚狀態可分為那三種？(3%) 其結構之聚集方式為何？(6%) 其各有何特徵？(6%)

三、人工合成 Polymer 之聚合方法有那二大類，請詳述之。(10%)

四、A hydrogen atom exists with its electron in the  $n=4$  state. The electron undergoes a transition to the  $n=3$  state. Calculate (a). The energy of the photon emitted? (4%) (b). Its frequency? (3%) And (c) Its wavelength in nanometer (nm)? (3%)

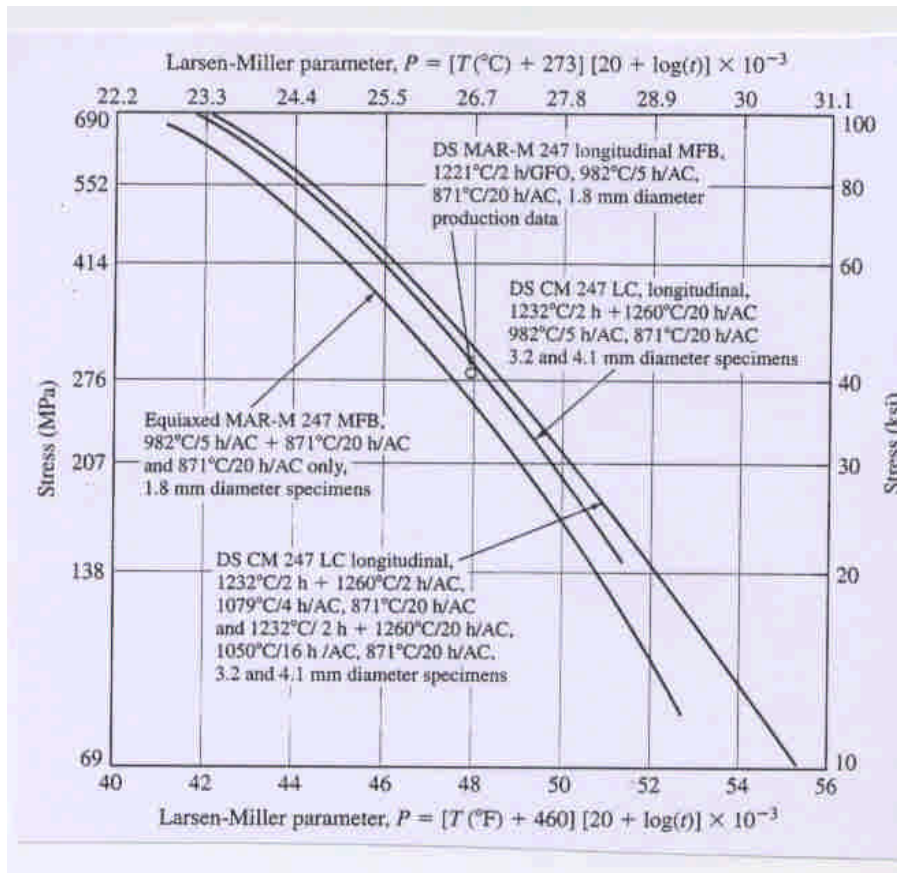
五、Use the following error function table to gas carburizing of a gear of 1020 steel at  $927^{\circ}\text{C}$ . Calculate the time in minutes necessary to increase the carbon content to 0.40% at 0.5mm below the surface. Assume that the carbon content at the surface is 0.90% and that the steel has a nominal carbon content of 0.20%.  $D_{927} = 1.28 \times 10^{-11} \text{ m}^2 / \text{s}$  (10%)

$z$	$\text{erf } z$	$z$	$\text{erf } z$	$z$	$\text{erf } z$	$z$	$\text{erf } z$
0	0	0.40	0.4284	0.85	0.7707	1.6	0.9763
0.025	0.0282	0.45	0.4755	0.90	0.7970	1.7	0.9838
0.05	0.0564	0.50	0.5205	0.95	0.8209	1.8	0.9891
0.10	0.1125	0.55	0.5633	1.0	0.8427	1.9	0.9928
0.15	0.1680	0.60	0.6039	1.1	0.8802	2.0	0.9953
0.20	0.2227	0.65	0.6420	1.2	0.9103	2.2	0.9981
0.25	0.2763	0.70	0.6778	1.3	0.9340	2.4	0.9993
0.30	0.3286	0.75	0.7112	1.4	0.9523	2.6	0.9998
0.35	0.3794	0.80	0.7421	1.5	0.9661	2.8	0.9999

六、An x-ray diffractometer recorder chart for an element that has either the BCC or FCC crystal structure shows diffraction peaks at the following  $2\theta$  angles: 40, 58, 73, 86.8, 100.4 and 114.7.  $\lambda=0.154 \text{ nm}$ . (a). Determine the cubic structure of the element? (4%) (b). Determine the lattice constant of the element? (6%)

七、Determine the critical crack length (mm) for an edge crack in a thick 2024-T6 alloy plate has a fracture toughness  $K_{IC} = 23.5 \text{ MPam}^{1/2}$  and is under a stress of 300MPa? Assume  $Y = \pi^{1/2}$ . (10%)

八、Using the Larsen-Miller parameter plot at a stress of 207 MPa (30 ksi), determine the time to stress-rupture at 980°C for an equiaxed MAR-M 247 MFB alloy? (10%)



九、CMC is made with continuous SiC fibers embedded in a glass-ceramic matrix as following figure. Calculate the tensile elastic modulus of the composite under isostrain conditions? (5%)

Glass-ceramic (GC) matrix:

$E = 94.0 \text{ GPa}$

SiC fibers:

$E = 350 \text{ GPa}$

