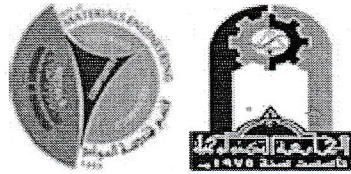



Ministry of Higher Education &  
Scientific Research  
University of Technology  
Materials Engineering Department

Subject: Principles of Eng. Mats  
Examiner: Dr. Abbas Khammas  
Allowed time: 3 hours



Final Examination (2014-2015)

وزارة التعليم العالي والبحث العلمي  
الجامعة التكنولوجية  
قسم هندسة المواد

Class: 1<sup>st</sup>  
Signature:   
Date: / 6 / 2015

**Answer 5 questions only**

Q1 :- (a) A dispersion-strengthened aluminum contains 10 Vol%  $Al_2O_3$  . Assuming that the metal phase is essentially pure aluminum , calculate the density of the composite , where the density of  $Al_2O_3$  is  $3.97 \text{ mg/m}^3$  and of aluminum is  $2.7 \text{ mg/m}^3$  .

(b) Why composites are important, discuss briefly the advantages and disadvantages of composites ( 10 marks)

Q2:- (a) What is meant by: Traditional Ceramics, New Ceramics, Thermoplastic, Thermosetting, MMC, CMC, PMC

(b) What are the basic properties of engineering materials ? (10 marks)

Q3 :-Assume the molecular weight distributions shown in table below are for PVC. For this material compute: (a) The number average molecular weight (b) Number average degree of polymerization (c) Weight average degree of polymerization (d) Polydispersity . NOTE: Atomic Weight for C= 12.01 g/mol, H= 1.01 g/mole and for Cl= 35.45 g/mole . ( 10 marks)

Molecular Weight Range (g/mole)	5000-10000	10000-15000	15000-20000	20000-25000	25000-30000
$X_i$	0.05	0.16	0.22	0.27	0.20
$W_i$	0.02	0.10	0.18	0.29	0.26

Q4 :- (a) Calculate the IPF of MgO , which has the NaCl Structure ( $r_{Mg}=0.078\text{nm}$ ,  $r_O=0.132 \text{ nm}$ )

(b) What are the main types of polymers? Explain briefly . ( 10 marks)

Q5:- (a) What is meant by rules of averaging under elastic loading for composites (b) What makes polymers unique? (c) Draw within a cubic unit cell the following planes:  $(00\bar{1})$ ,  $(\bar{1}\bar{1}\bar{1})$  ( 10 marks)

Q6 :- ( a) What is the classification scheme for various ferrous alloys (b) Explain briefly the general properties of the following non-ferrous alloys: refractory metals, Titanium alloys, Nickel alloys (c) Differentiate between elastic and plastic deformation . ( 10 marks)

.....GOOD LUCK.....