

COLLEGE OF ENGINEERING, PUNE – 5.

(An Autonomous Institute of Government of Maharashtra)

End-Semester Examination (2012-13)

B.Tech. (Metallurgy)

MT 424: Surface Modification

Date: 27th April 2013

Time: 2.00 – 5.00 p.m.

Time allowed: 3 hrs

Max. Marks: 50

Instructions to students:

- i) There are no sections.
- ii) Numbers to the right indicates full marks.
- iii) Draw sketches wherever necessary.
- iv) All questions are compulsory.
- v) Exchange of calculator not allowed.

Marks

- Q.1 Discuss wear behavior of Al_2O_3 and SiC coated Ti-6Al-4V alloy developed using plasma spraying method. **10**
- Q.2 a) A silicon wafer with a series of windows in an oxide layer is undergoing ion implantation with a beam of boron ions at 100 keV. If the beam dose is $3.0 \times 10^{15} \text{ cm}^{-2}$ and projected straggle range is 900 \AA , what is the peak concentration of the boron ions at the projected range? **10**
- b) How hexavalent chromium is reduced to trivalent chromium?
- Q.3 a) In electroplating, how long will it take to deposit 0.02 g of copper from copper sulfate electrolyte at current 0.2 A? If 96500 coulombs of electricity liberates one gram equivalent of any substance and chemical equivalent of copper is taken as 32. **10**
- b) Discuss electro less deposition of high phosphorous Ni-P-Si₃N₄ composite coating.
- Q.4 To produce a p-type semiconductor, third column element boron is doped in pure silicon. The doping is done through a B₂O₃ vapor phase of partial pressure equal to 1.5 N/m^2 . This atmosphere is equivalent to surface concentration of 3×10^{26} boron atoms per m³. Calculate the time required to get a boron content of 10^{23} atoms per m³ at a depth of 2 μm . The doping temperature is 1100°C **10**

and $D_{B \text{ in Si}}$ at this temperature is $4.0 \times 10^{-17} \text{ m}^2/\text{s}$.

Z	erf (Z)	Z	erf (Z)
1.8	0.9891	2.4	0.9993
2.0	0.9953	2.6	0.9998
2.2	0.9981	2.8	0.9999

- Q.5 a) Explain how Silicon nitride film deposited on integrated circuits by Chemical Vapor Deposition method. 5
- b) Discuss the parameters on which the properties of a film of a material formed by any Physical Vapor Deposition process depend. 5

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All the best