ME254: Materials Engineering Homework 5 Due: Monday, November 24, 2014

1st semester 1435-1436 H Instructor: Dr. Hamad F. Alharbi

Problem 1

A cylindrical metal rod having a diameter of 14.5 mm and a gauge length of 40 mm is to be subjected to a tensile load along the rod axis. The following load-elongation data was measured in the lab under a tensile test:

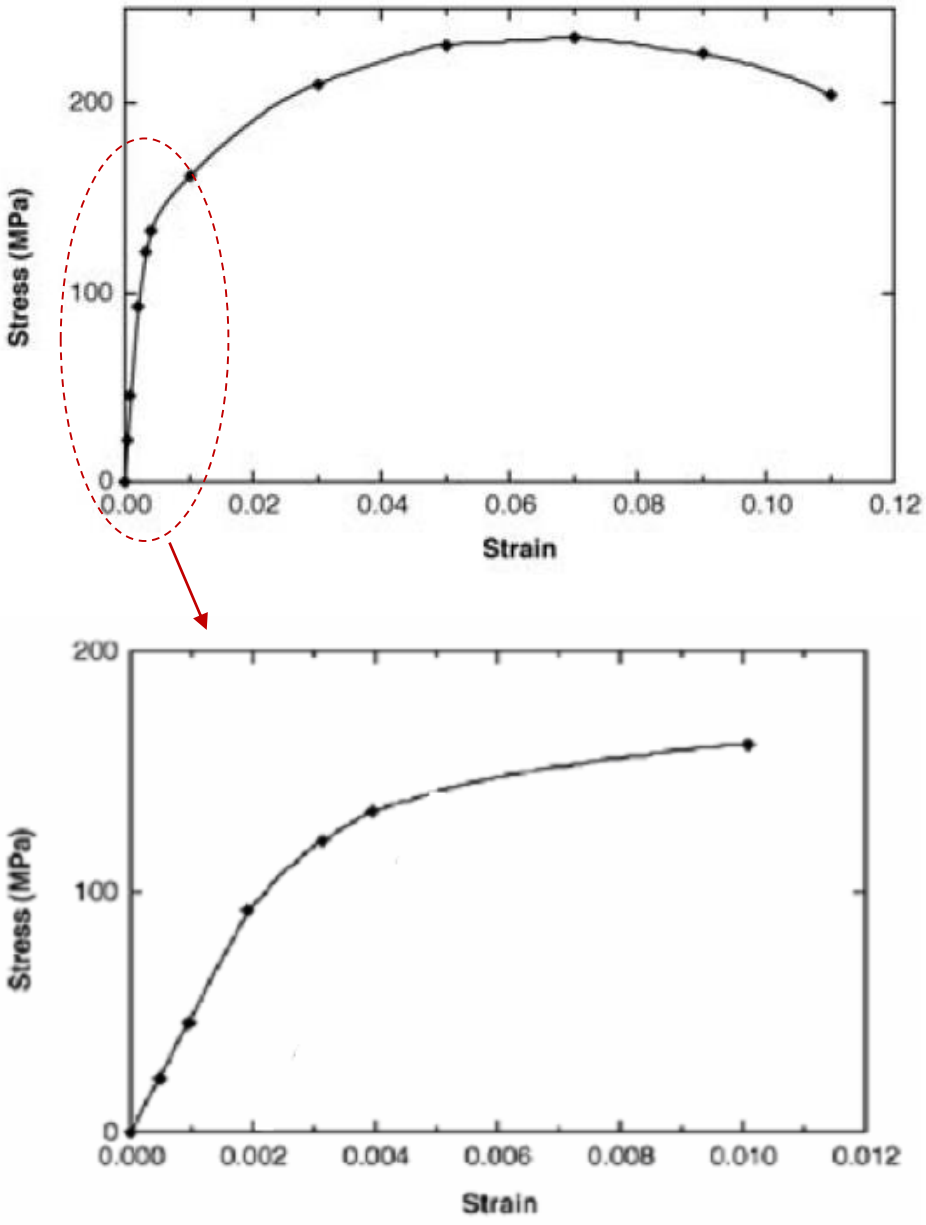
Length (mm)	Load (N)
40.00	0.00
40.07	22251.00
40.09	28609.00
40.11	34966.00
40.15	47681.00
40.23	72956.00
40.33	80669.00
40.43	84840.00
40.63	93969.00
40.83	100970.00
41.63	117820.00
42.43	125130.00
42.83	126240.00
43.23	125530.00
44.03	119230.00
44.63	98140.00

Compute the following:

a. The modulus of elasticity?
b. The yield strength using 0.2% offset method
c. The ductility using percent elongation
d. Calculate the strain hardening exponent n and the stress coefficient K?
e. The elastic and plastic (permanent) strains at applied loads of 28609 Newton and 100970 Newton?

Problem 2

The engineering stress – strain curve is shown for a cylindrical tensile specimen of an aluminum alloy. The initial part is also shown on a separate graph. Initial cross section area is 40 mm^2 and initial length is 200 mm. Poisson ratio is given as 0.3.



Use the above stress – strain response to calculate the following:

a) Modulus of elasticity.
b) Offset yield strength.
c) Permanent strain upon unloading from 150 MPa.
d) Modulus of resilience.
e) Change in diameter at a stress of 200 MPa.
f) Modulus of toughness.
g) Strength coefficient (k)
h) Strain hardening exponent (n)
i) What is the instantaneous cross section area at an engineering strain of 0.02.
j) What is the instantaneous length at an engineering strain of 0.02.
k) Does the alloy undergo plastic deformation at a load of 7 KN.