

Assignment-8 solution

Heat treatment and surface hardening-II

1) The volume fraction (V_v) of a graphite nodules measured from an arbitrary microstructure have been shown in the table below

V_v
0.50
0.58
0.60
0.67
0.70
0.80

The mean (\bar{X}) and unbiased standard deviation of the volume fraction for the given data will be:

a) 0.64 and 0.10, respectively.

b) 0.64 and 0.16, respectively.

c) 0.90 and 0.15, respectively.

d) 0.50 and 0.18, respectively.

2) In question 1, if obtained mean values from different sets of measurements follows normal distribution then the mean value of V_v at 95% confidence level will lie in the range of: [see lecture no. 37 for additional data].

a) $0.35 \leq 0.40 \leq 0.45$.

b) $0.45 \leq 0.50 \leq 0.55$.

c) $0.55 \leq 0.60 \leq 0.61$.

d) $0.56 \leq 0.64 \leq 0.72$.

3) In question 1, if obtained mean values from different sets of measurements follows t-distribution then the mean value of V_v at 95% confidence level will lie in the range of: [see lecture no. 37 for additional data].

a) $0.35 \leq 0.40 \leq 0.45$

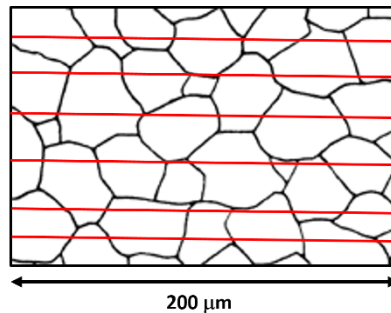
b) $0.45 \leq 0.50 \leq 0.55$

c) $0.54 \leq 0.64 \leq 0.74$

d) $0.63 \leq 0.64 \leq 0.65$

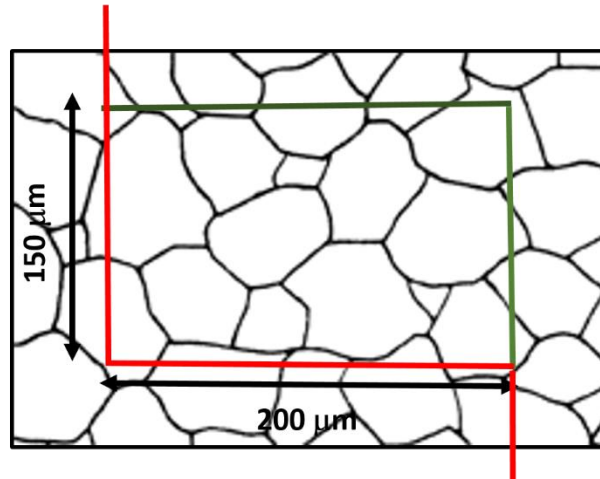
- 4) What inference you will get from the solution of question 2 and 3?
- There is no difference between the range of mean i.e. $(A \leq \bar{X} \leq B)$ for normal and t-distribution at 95% confidence interval.
 - Range of mean is broader for t-distribution compared to normal distribution at 95% confidence interval.
 - Range of mean is broader for normal distribution compared to t-distribution at 95% confidence interval.
 - All of the above statements are correct.

5) The mean intercept length of the grain in the given microstructure as shown below lies in the range of: [Mark the closest possible range]



- 25 to 40 μm
- 16 to 25 μm
- 10 to 15 μm
- 5 to 10 μm

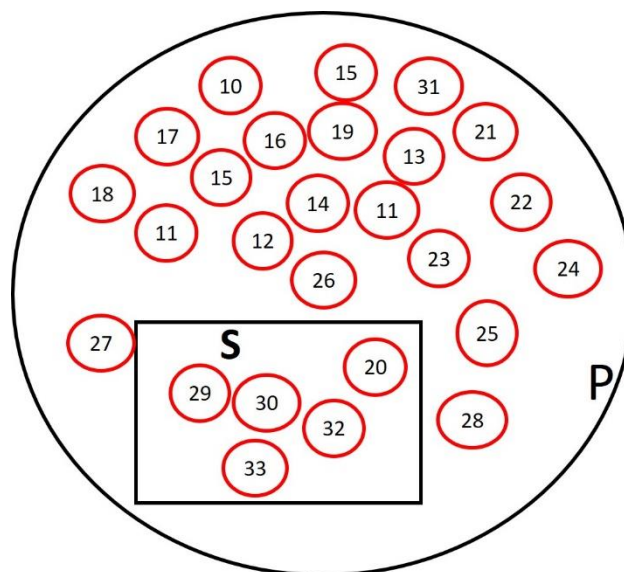
6) A mesh of size $200\mu\text{m} \times 150\mu\text{m}$ have been superimposed on the microstructure of polycrystalline material. The average grain area in given microstructure will lie in the range of: [Note: red and green lines have their usual meaning and mark the closest possible range].



- a) 4500-5000 μm^2
- b) 3600-4100 μm^2
- c) 4000- 4500 μm^2
- d) 1800-2300 μm^2

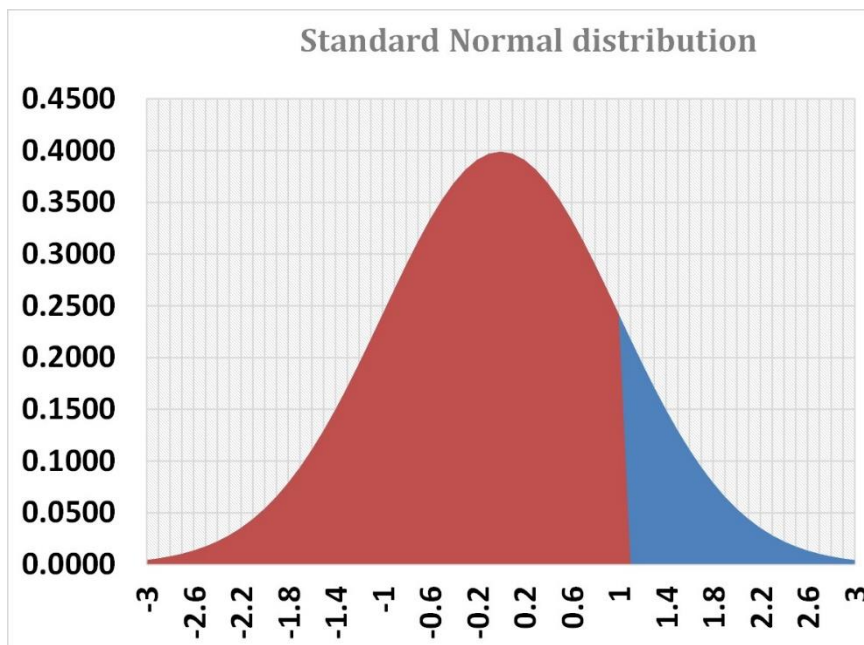
7) From the population P containing particles of different diameters (shown inside the red particles), a random sample S (rectangle box) has been withdrawn. The standard deviation of the diameter for random sample (S) i.e. (s) and population (P) i.e. (σ) are:

- a) 6.2 and 6.9, respectively.
- b) 4.8 and 6.1, respectively.
- c) 5.2 and 7.1, respectively.
- d) 9.0 and 5.1, respectively.



8) The cumulative area (only red) as shown in figure below under the standard normal distribution (Mean=0, Std. deviation =1) will lie in the range of: [please use *Microsoft excel* to calculate this area.]

- a) 0.83-0.85
- b) 0.80-0.82
- c) 0.78-0.80
- d) 0.85-0.87



9) Which one of the following statements is correct with respect to Grossmann's hardenability test?

- (a) Large rectangular samples of same cross-section is required.
- (b) Cylindrical samples of same diameter is required.
- (c) For a given diameter (D), if the microstructure in the centre has 50% martensite, then this D is known as $D_{critical}$.
- (d) None of the above.

10) Which one of the following statements is correct?

- (a) Large number of samples is required in Jominy end quench test.
- (b) Water is sprayed from the top side (hanged side) and heat transfer occur from bottom side to top side in Jominy end quench test.
- (c) Steels with very high hardenability would have very high depth up to which martensite can form.
- (d) Both (a) and (b).