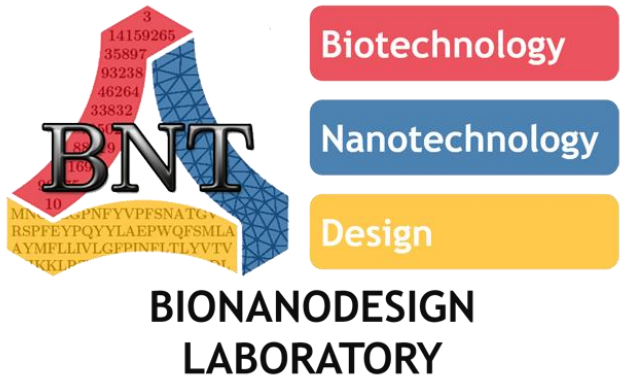
BMM 205 L
Malzeme Biliminin Temelleri Laboratuvarı



SERTLİK DENEYİ

Tarih: 19.06.2020

Öğretim Üyesi: Dr. Ersin Emre Ören

Laboratuvar Asistanları: Çağlanaz Akın ve Büşra Demir

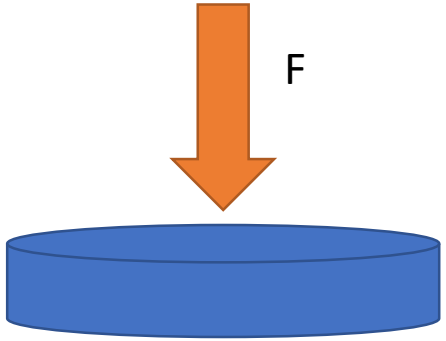
Deney Föyü: http://eeoren.etu.edu.tr/BMM205/dosyalar/BMM205L_Sertlik_Deneyi.pdf

Rapor Teslim Tarihi: 26.06.2020

Rapor Hazırlama Rehberi: http://eeoren.etu.edu.tr/BMM205/dosyalar/BMM205L-Rapor_Haz%C4%B1rlama_Rehberi.docx

Sertlik malzemenin basma yönünde plastik deformasyona gösterdiği direncin ölçüsüdür.
Sertlik ölçme yönteminin temeli, malzeme üzerindeki kalıcı izlerin ölçülmesidir.

- Derinlik
- Genişlik / Alan



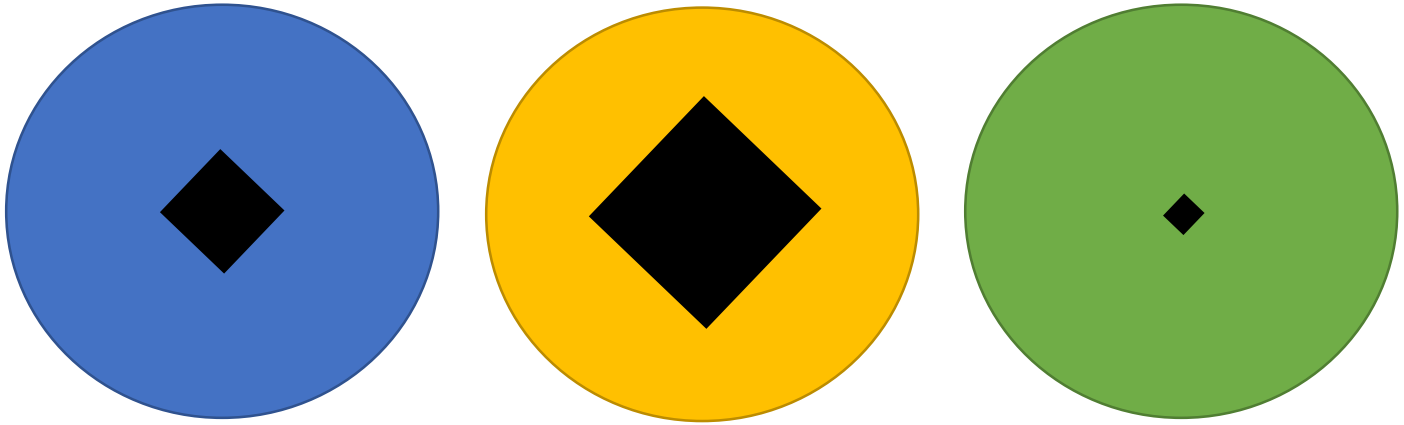


Figure 6.18 Comparison of several hardness scales. (Adapted from G. F. Kinney, *Engineering Properties and Applications of Plastics*, p. 202. Copyright © 1957 by John Wiley & Sons, New York. Reprinted by permission of John Wiley & Sons, Inc.)

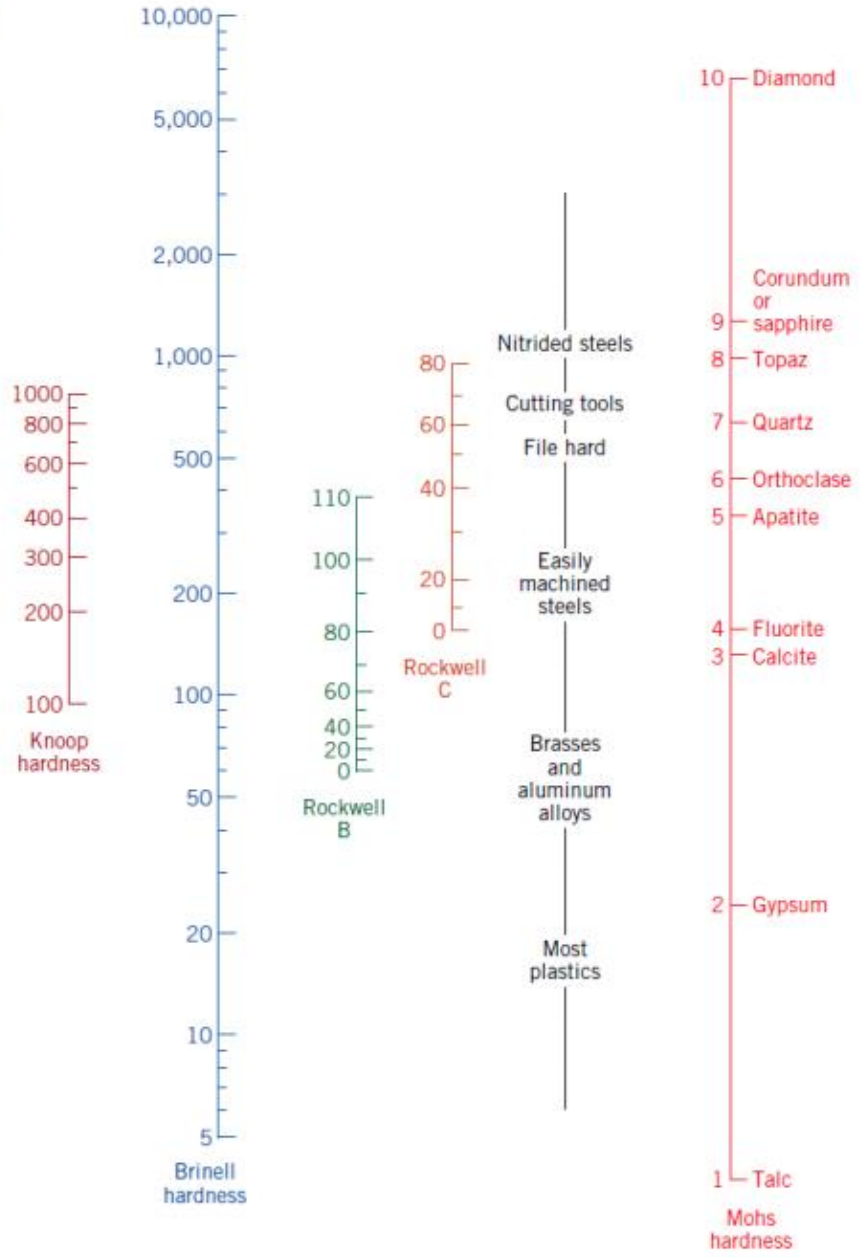
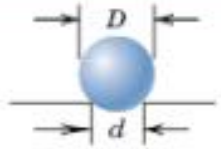
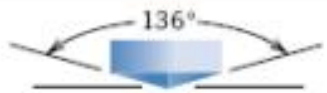
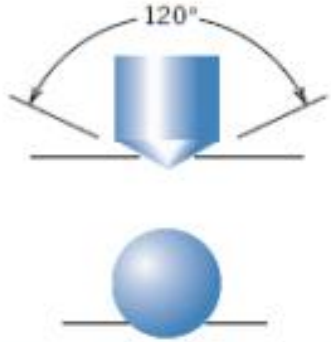


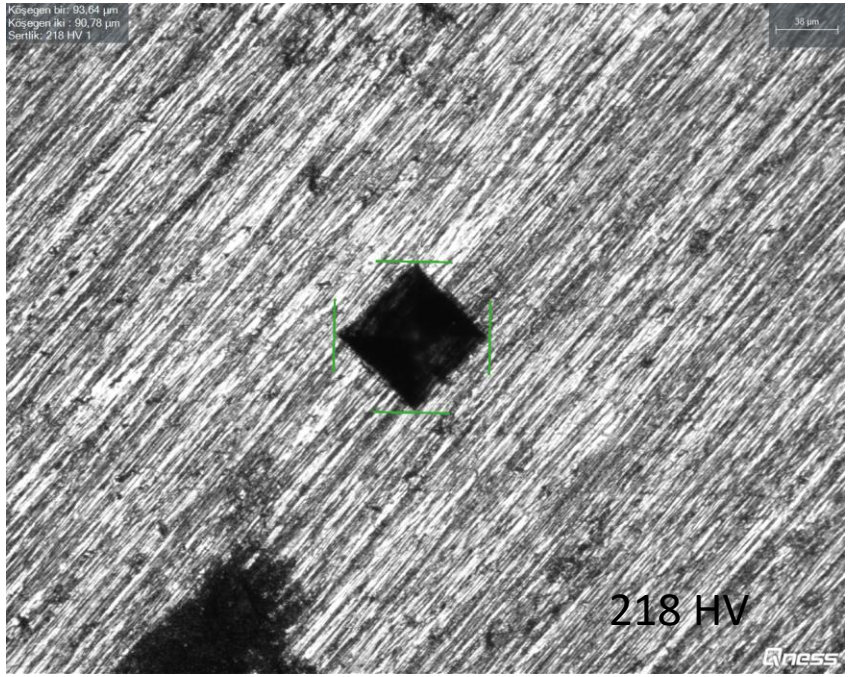
Table 6.5 Hardness-Testing Techniques

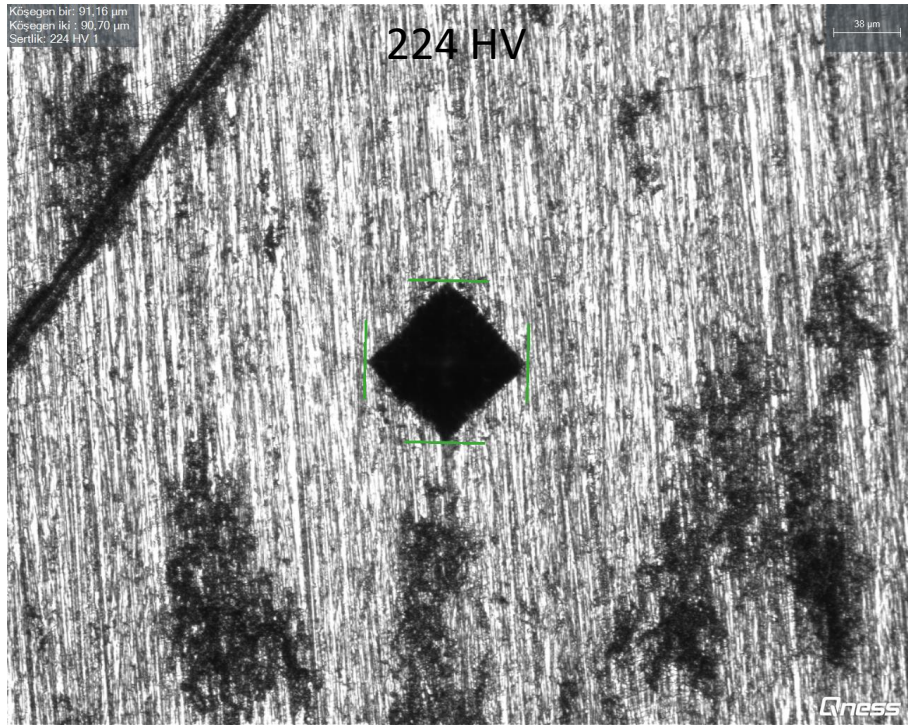
Test	Indenter	Shape of Indentation: Side View	Shape of Indentation: Top View	Load	Formula for Hardness Number[a]
Brinell	10-mm sphere of steel or tungsten carbide			P	$\mathrm{HB} = \dfrac{2P}{\pi D[D - \sqrt{D^2 - d^2}]}$
Vickers microhardness	Diamond pyramid			P	$\mathrm{HV} = 1.854P/d_1^2$
Knoop microhardness	Diamond pyramid			P	$\mathrm{HK} = 14.2P/l^2$
Rockwell and superficial Rockwell	Diamond cone; $\frac{1}{16}$-, $\frac{1}{8}$-, $\frac{1}{4}$-, $\frac{1}{2}$-in.-diameter steel spheres			60 kg, 100 kg, 150 kg: Rockwell 15 kg, 30 kg, 45 kg: Superficial Rockwell	

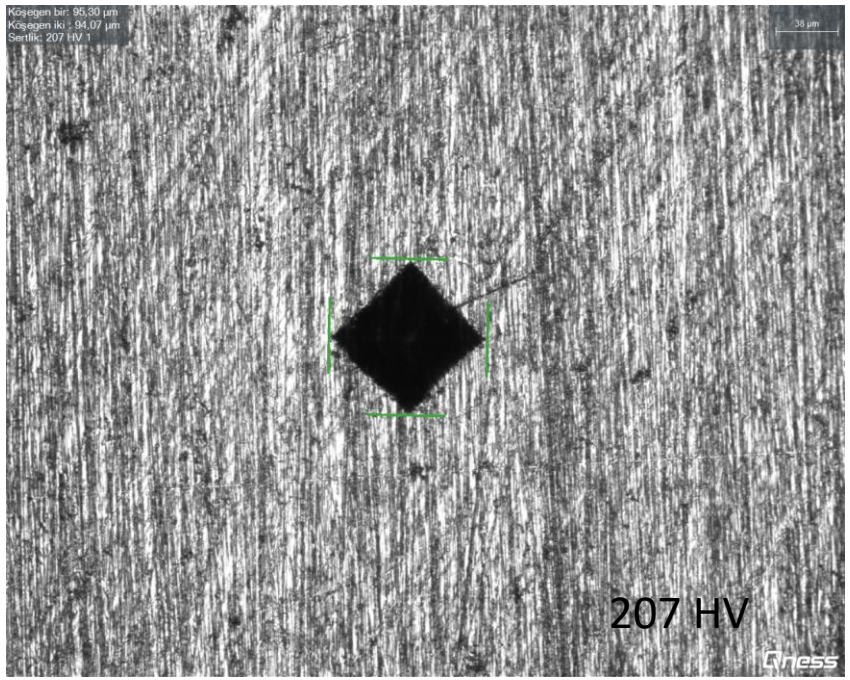
[a]For the hardness formulas given, P (the applied load) is in kg, whereas D, d, d_1, and l are all in mm.

Source: Adapted from H. W. Hayden, W. G. Moffatt, and J. Wulff, *The Structure and Properties of Materials*, Vol. III, *Mechanical Behavior*. Copyright © 1965 by John Wiley & Sons, New York. Reprinted by permission of John Wiley & Sons, Inc.

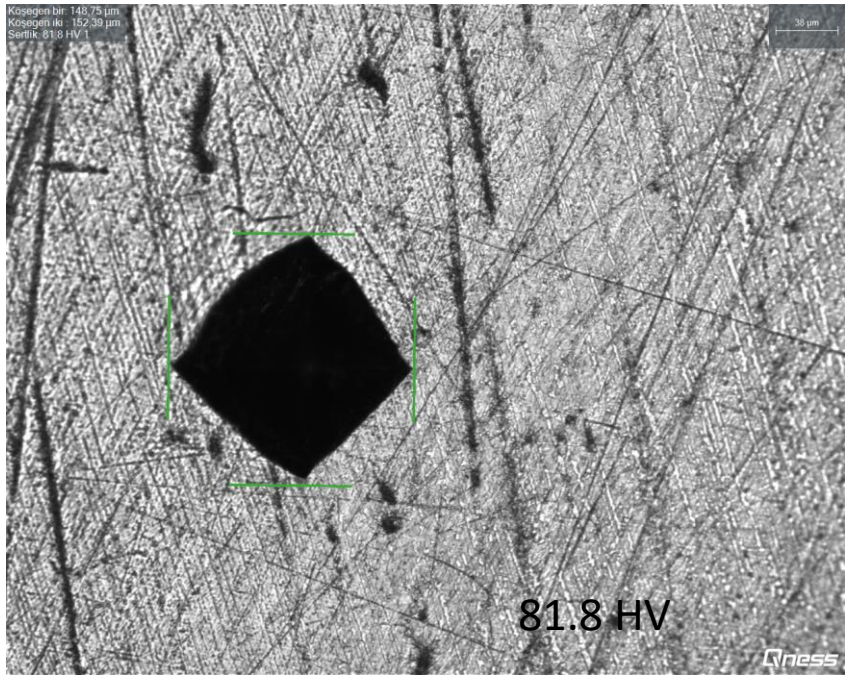
St 37 Normal

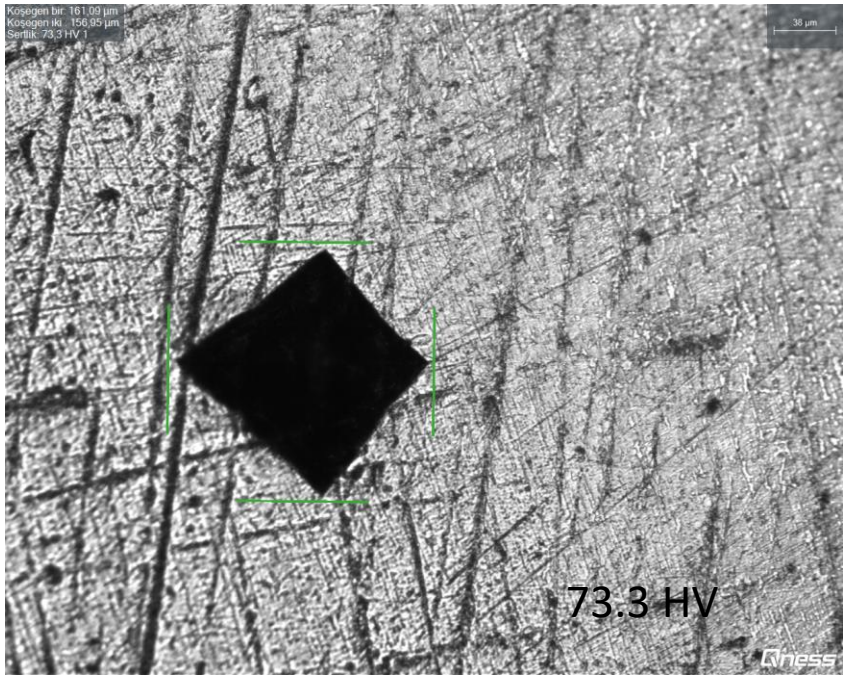

Köşegen bir: 93,64 µm
Köşegen iki : 90,78 µm
Sertlik: 218 HV 1
38 µm
218 HV
Qness

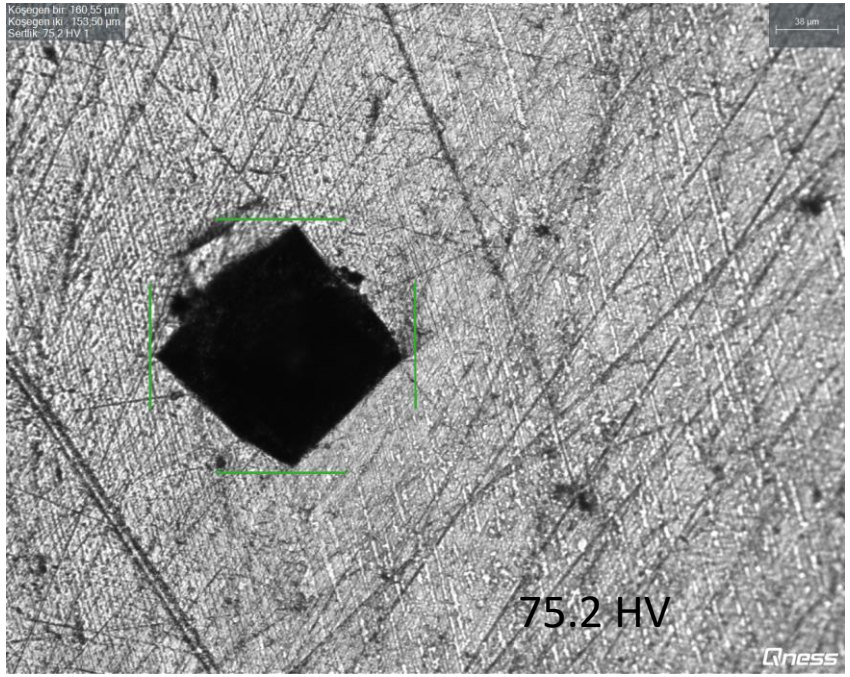

Köşegen bir: 91,16 µm
Köşegen iki : 90,70 µm
Sertlik: 224 HV 1
224 HV
38 µm
Qness


Köşegen bir: 95,30 µm
Köşegen iki : 94,07 µm
Sertlik: 207 HV 1
38 µm
207 HV
Qness

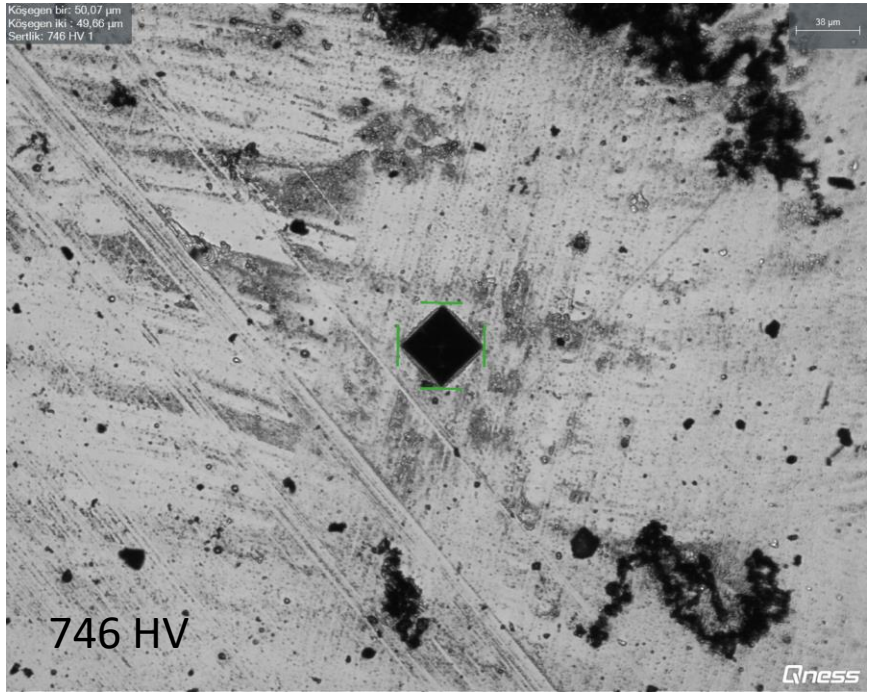
Aluminum 6063-T6

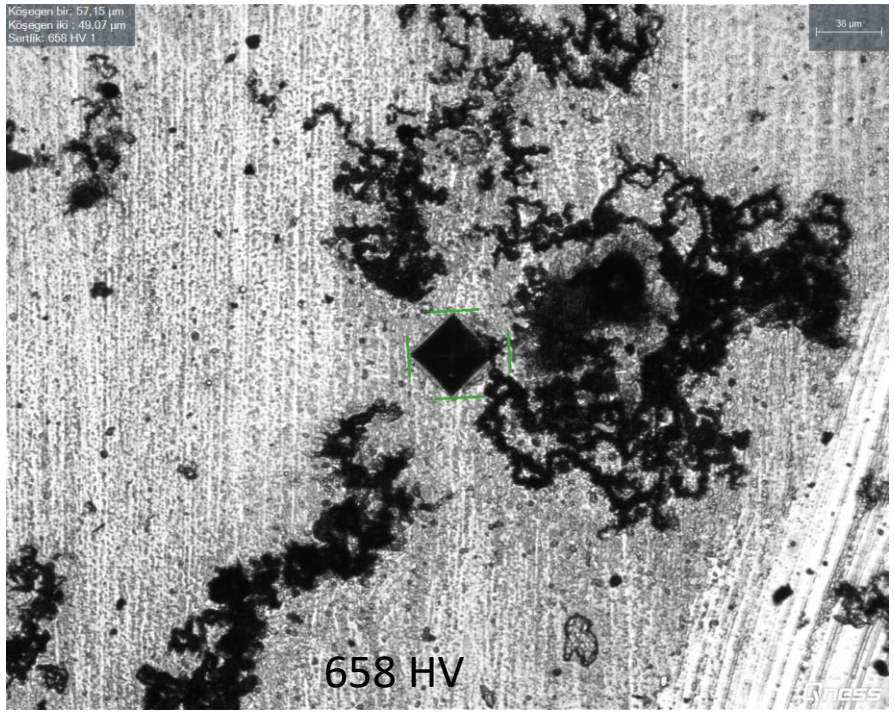


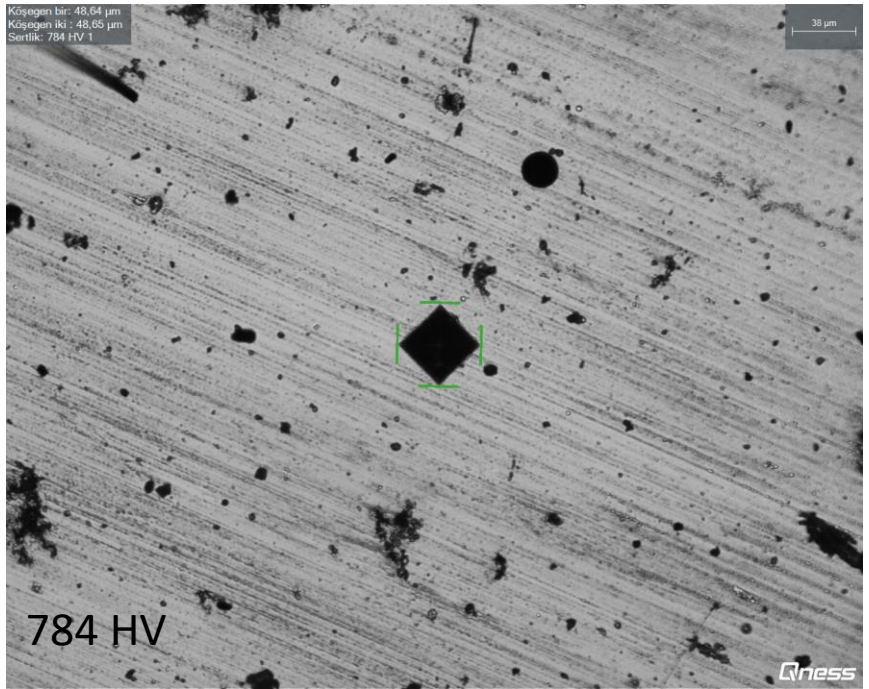




St 37 Sertleştirilmiş







Standard Sapma

Üretilen numunelerdeki veya bir numunenin farklı bölgelerindeki özelliklerdeki değişimin bir ölçüsüdür.

Çok önemli bir tasarım parametresidir!

Ortalama (Average)

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

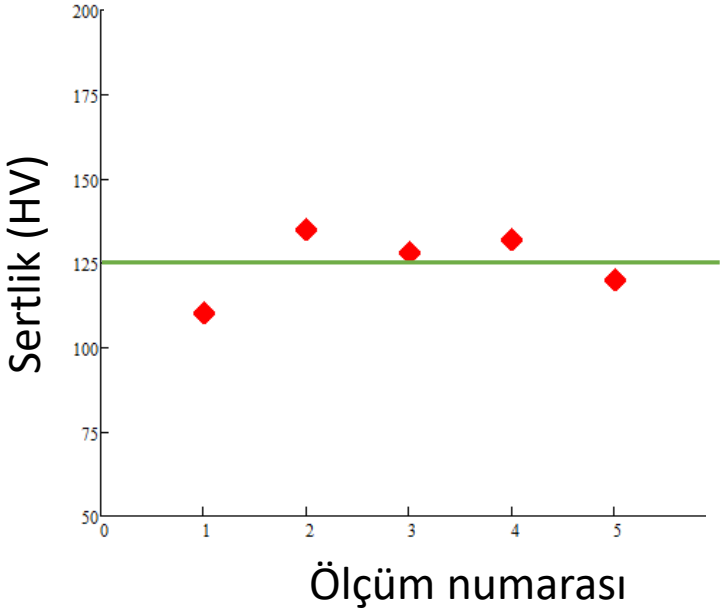
Standard Sapma (Standard Deviation):

$$s = \left[\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1} \right]^{1/2}$$

Örnek:

Test sonuçları: 110, 135, 128, 132, 120

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{110+135+128+132+120}{5} = 125$$

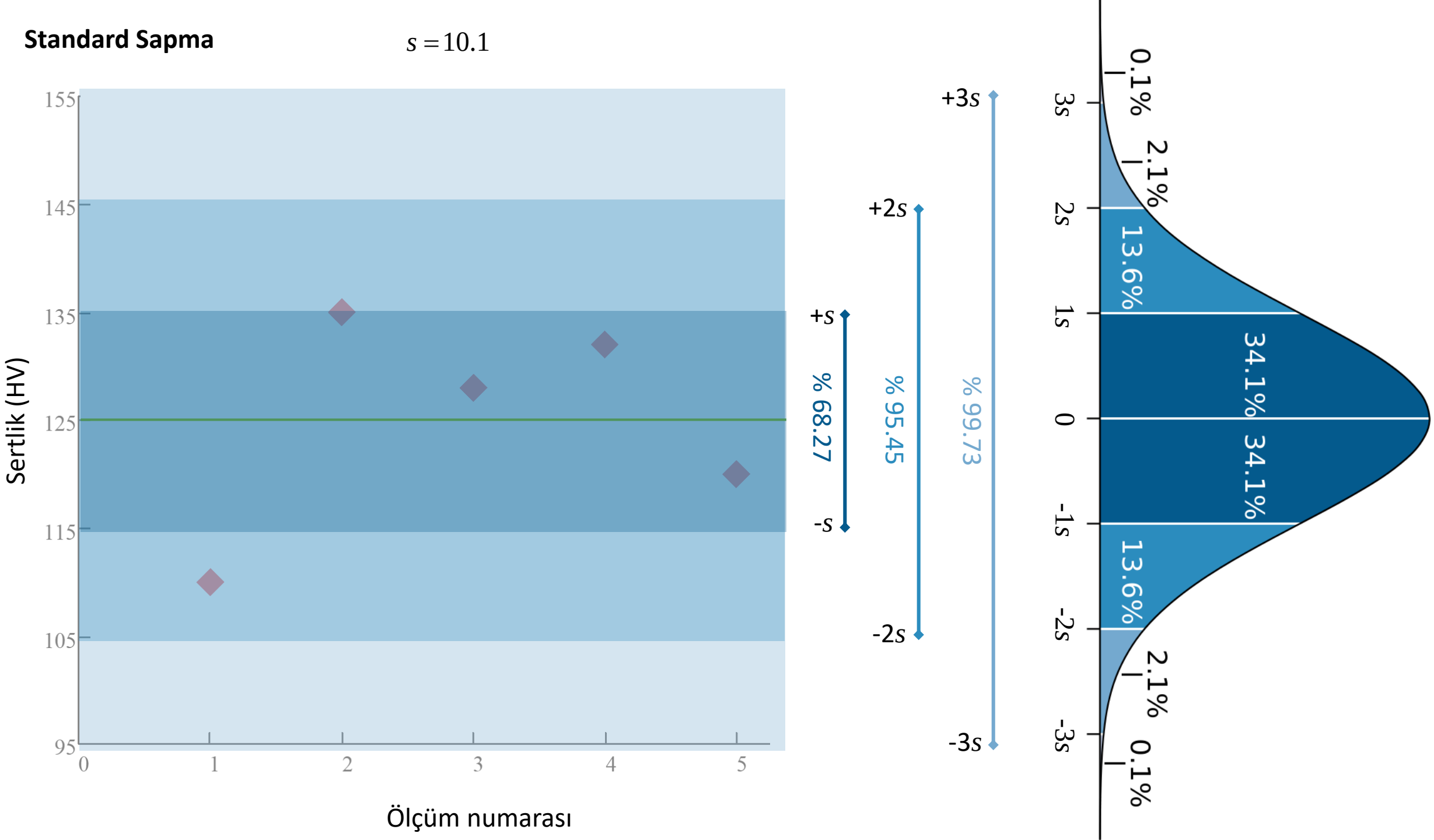


$$s = \left[\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1} \right]^{1/2}$$

$$= \left[\frac{(110-125)^2 + (135-125)^2 + (128-125)^2 + (132-125)^2 + (120-125)^2}{4} \right]^{1/2}$$

$$= \left[\frac{225+100+9+49+25}{4} \right]^{1/2} = \left[\frac{408}{4} \right]^{1/2} = [102]^{1/2} = 10.1$$

Standard Sapma $s = 10.1$



TEST SONUÇLARI

NUMUNE	YÖNTEM	ÖLÇÜMLER									
St 37	Vickers (HV)	218.0	207.0	224.0	220.5	222.6	222.6	221.6	221.0	222.2	222.4
Al 6063-T6		81.8	75.2	73.3	76.1	75.0	75.1	74.9	76.1	75.5	75.3
St 37 Sertleştirilmiş		746.0	784.0	658.0	785.0	783.0	784.5	784.2	785.0	784.9	785.0

ÖLÇÜMLER VE HESAPLAMALAR:

Sertlik ölçümlerini aşağıda verilen Tablo'ya benzer şekilde hazırlayınız.

Numune	Yöntem	Ölçümler					Ortalama	Standart Sapma

Aşağıdaki hesaplamaları yapınız.

(a) Her bir numune için ortalama sertlik değerini hesaplayınız.

(b) Standart sapmayı hesaplayınız.

Sonuçları sertlik deneyi yapılan metalik malzemelerin literatürdeki sertlik değerlerini göz önünde bulundurarak irdeleyiniz.