Tüdoksad Akademi 2. Ulusal Döküm Kongresi
2nd National Foundry Congress by Tudoksad Academy
İzmir/Türkiye
30 Kasım-1 Aralık 2019

A356 ALAŞIMINDA VANADYUM VE BOR İLAVESİNİN MEKANİK ÖZELLİKLERE ETKİSİ

Özkan KESEN

Okan AYDIN
Selim TEMEL
Furkan TEZER
Hayati SAHIN
Merve ATIK
Doç.Dr.Derya DISPINAR

Istanbul Technical University

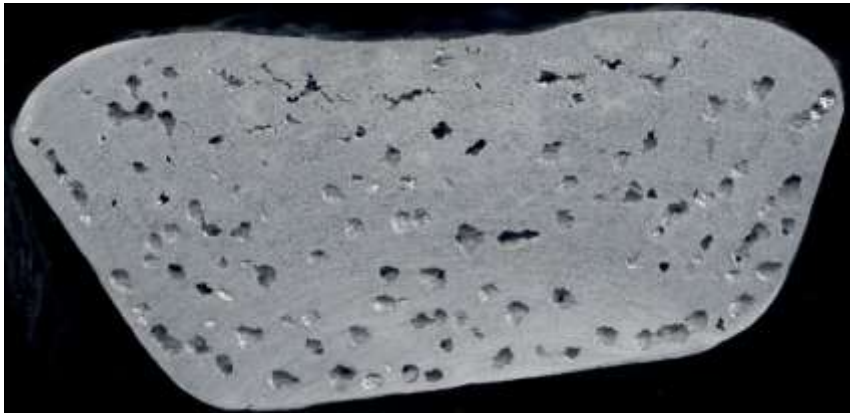
Motivasyon

- Bu çalışmada, bifilmin boyutunun ve konumunun etkileri ANSYS ile incelenmiştir.

- Analizlerde, CT Scan ile taranan numune üzerinden çekme çubuğu çizilmiş ve ANSYS ile stres analizi yapılmıştır.

Deneysel Çalışma

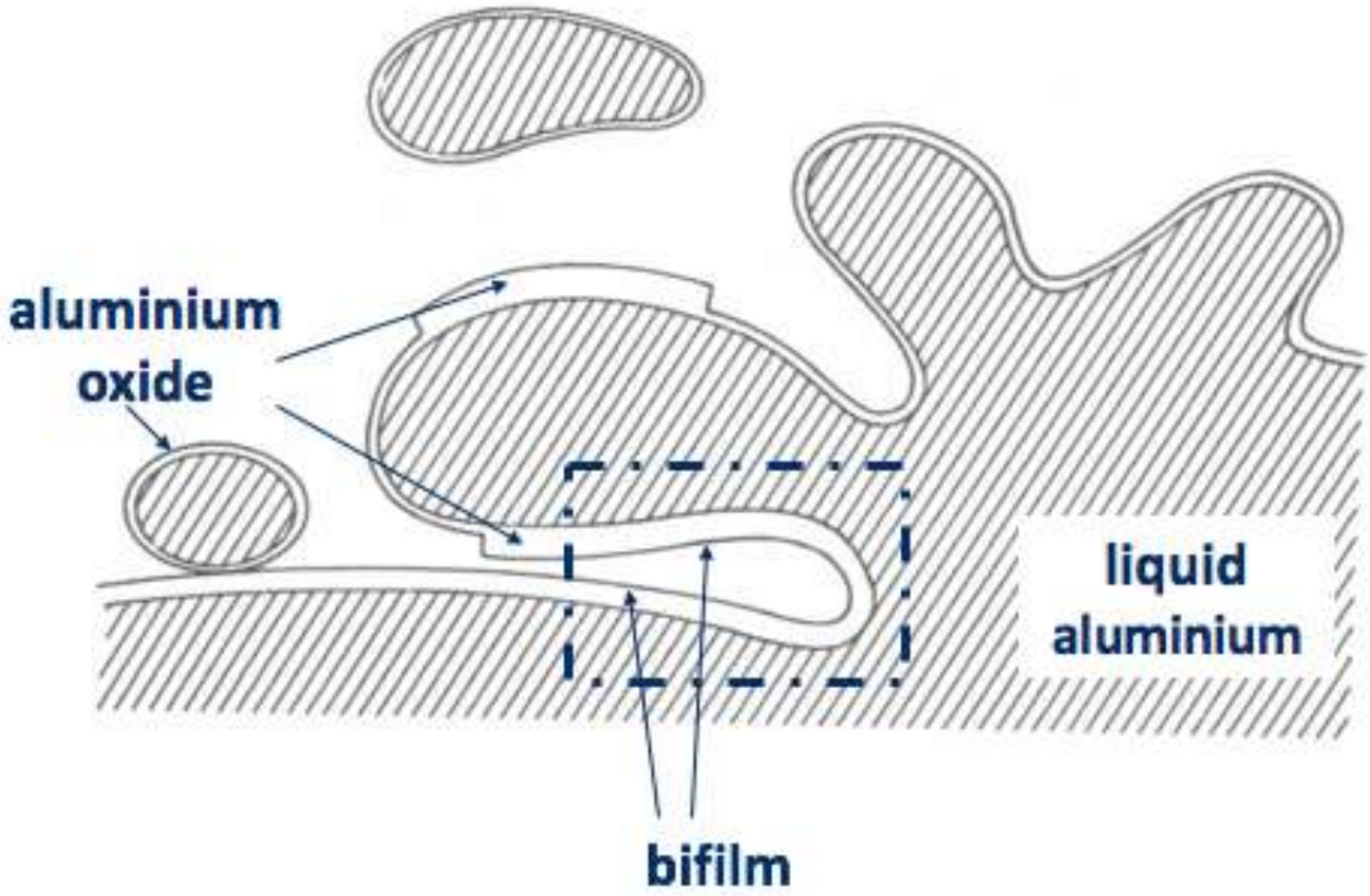
- Bifilmin boyutunun ve konumunun etkisini görmek için yapılan dökümlerden alınan çekme çubuklarına CT Scan ile tarama yapılmış ve stres analizine tabi tutulmuştur.
- A356 alaşımı üzerinde vanadium ve borun tane inceltme etkisini incelemek adına %0,05 oranında ilaveler yapılmıştır.

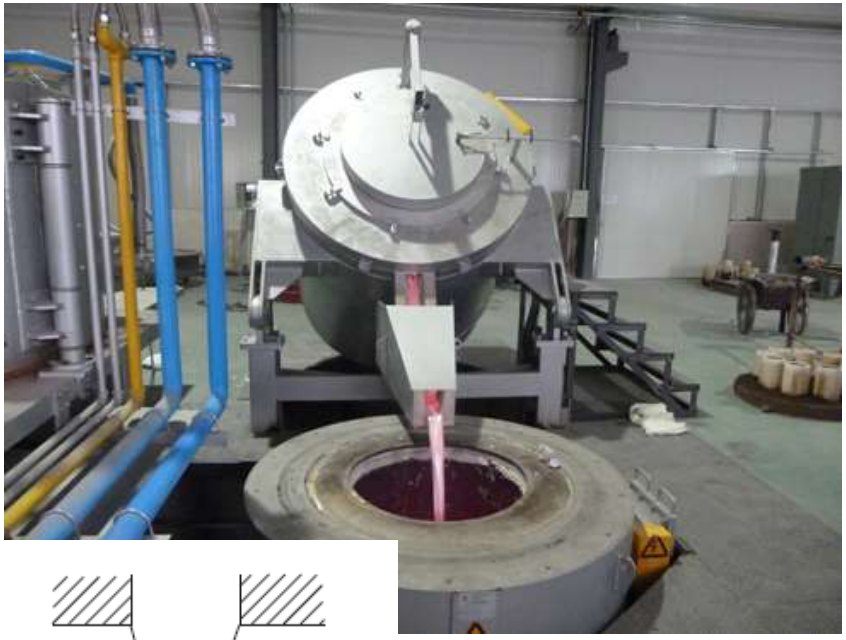


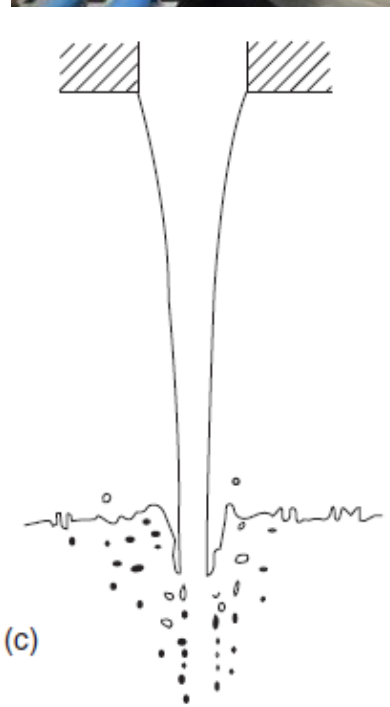
Bor İlaveli

Vanadyum İlaveli

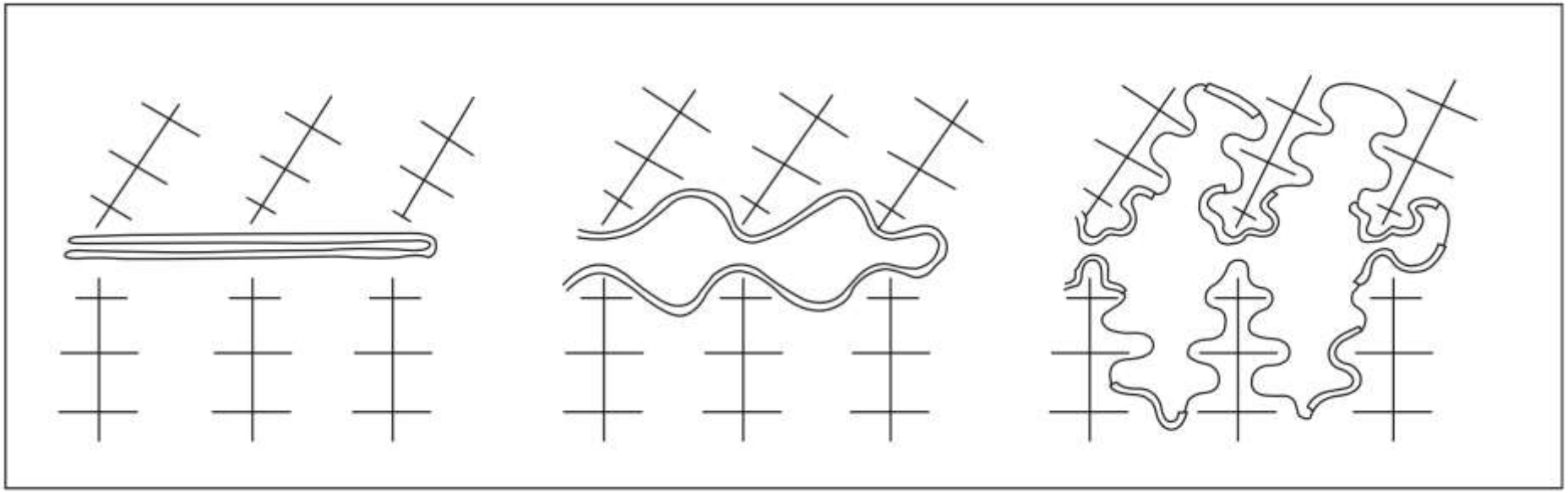
Bifilmlerin Oluşum Mekanizması



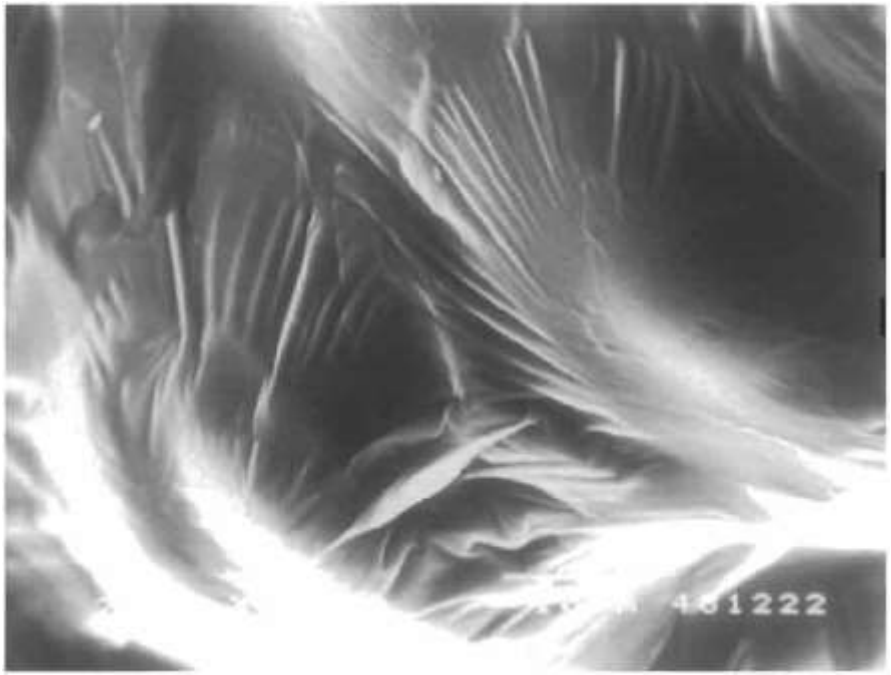


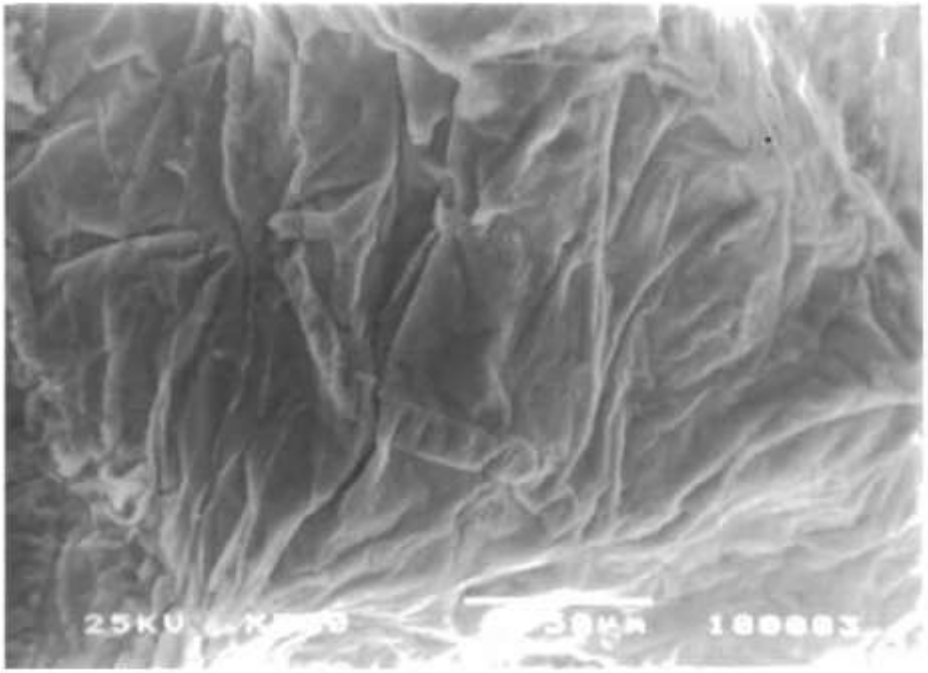

(c)

Bifilm ve Porozite oluşumu



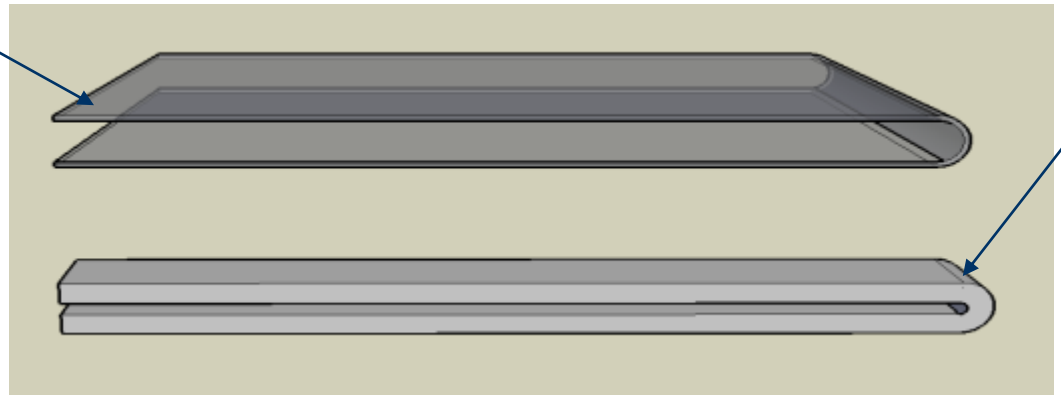
Bifilmlerin malzeme üzerindeki etkisini incelemek adına farklı şekillerde ve boyutlarda bifilmler çekme çubuğu içerisine yerleştirilmiş ve ANSYS ile stress analizleri yapılmıştır.



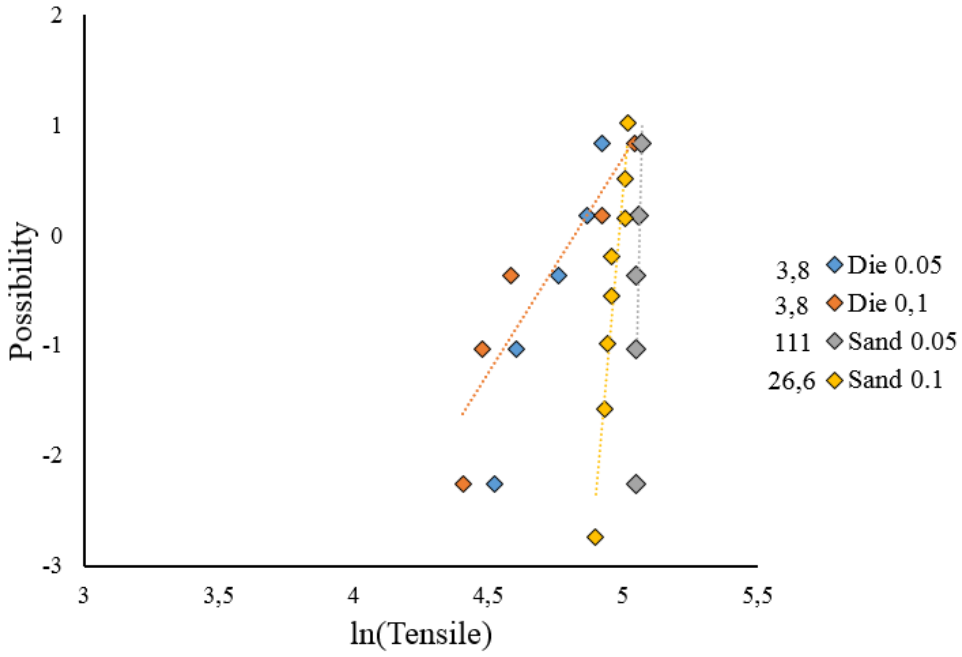


Yeni oksit : Amorf ve İnce

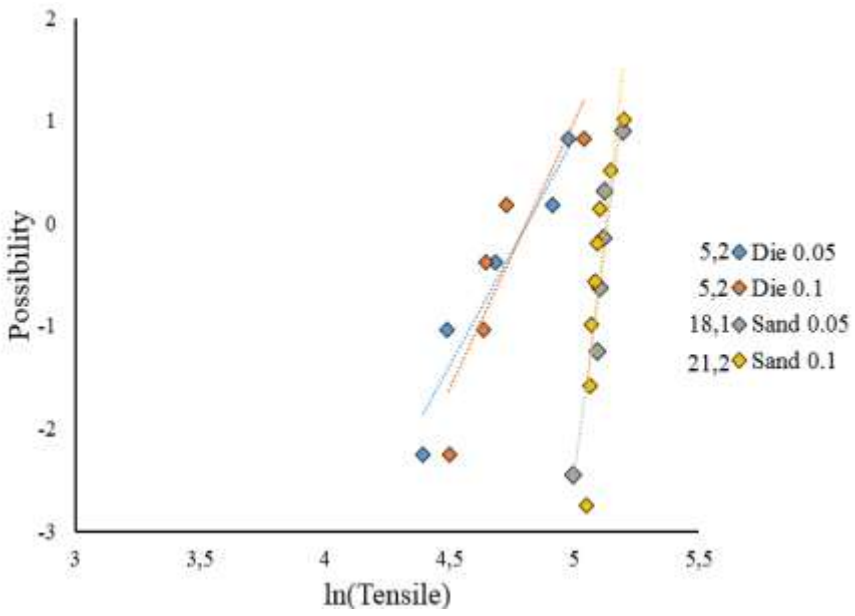
Eski Oksit: Kristalin ve Kalın



Çekme Mukavemetinin Weibull Grafikleri

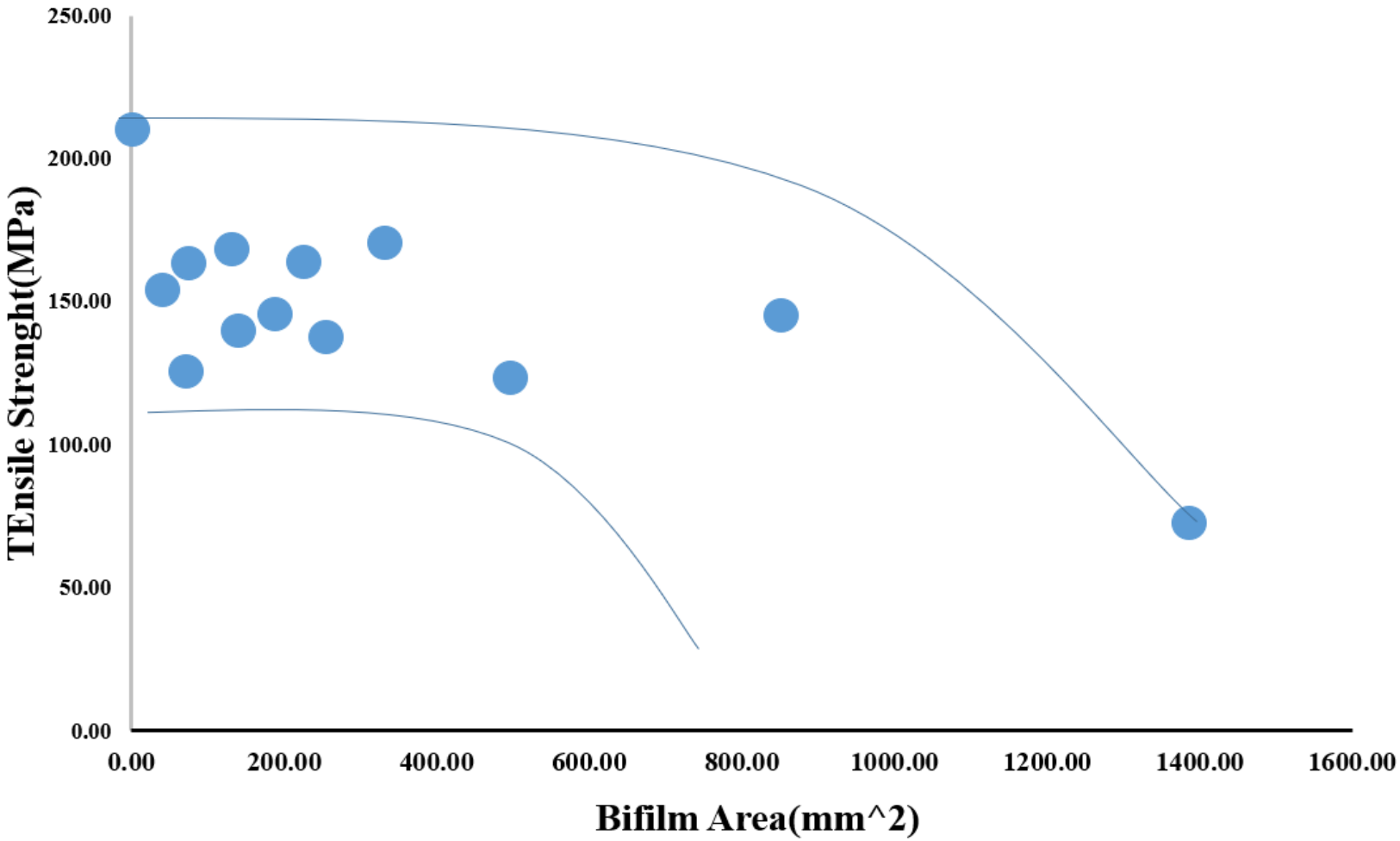


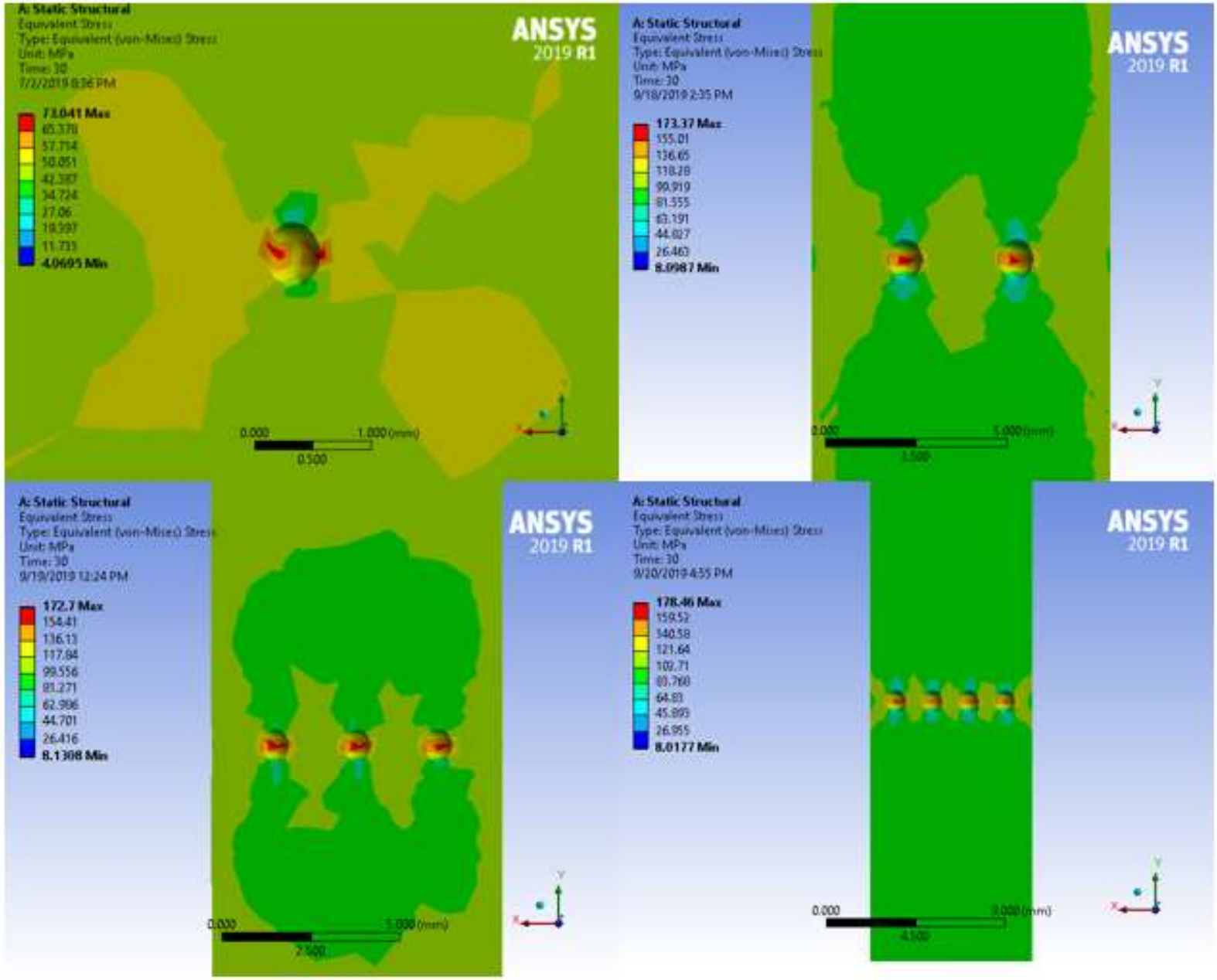
Boron

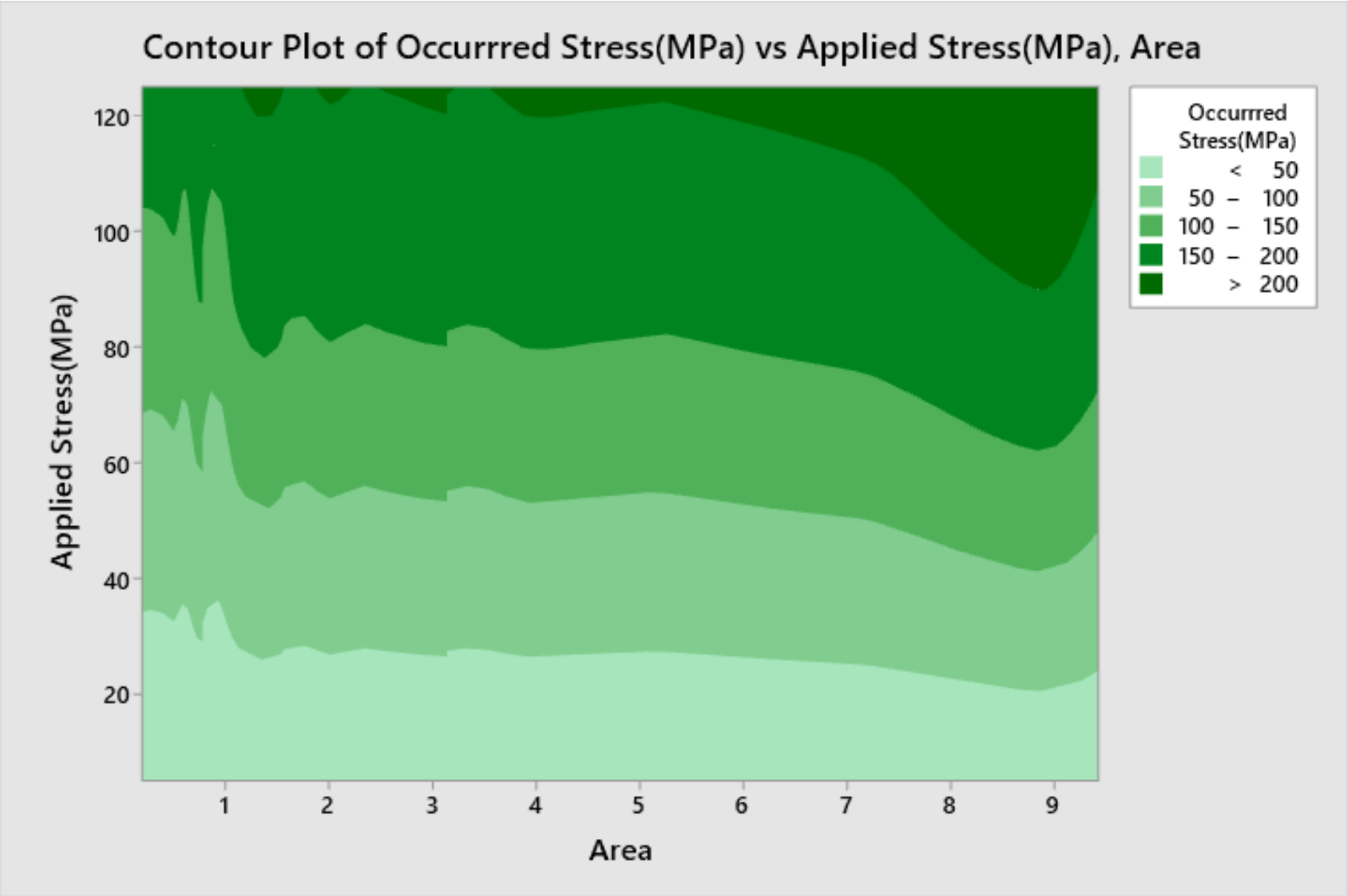


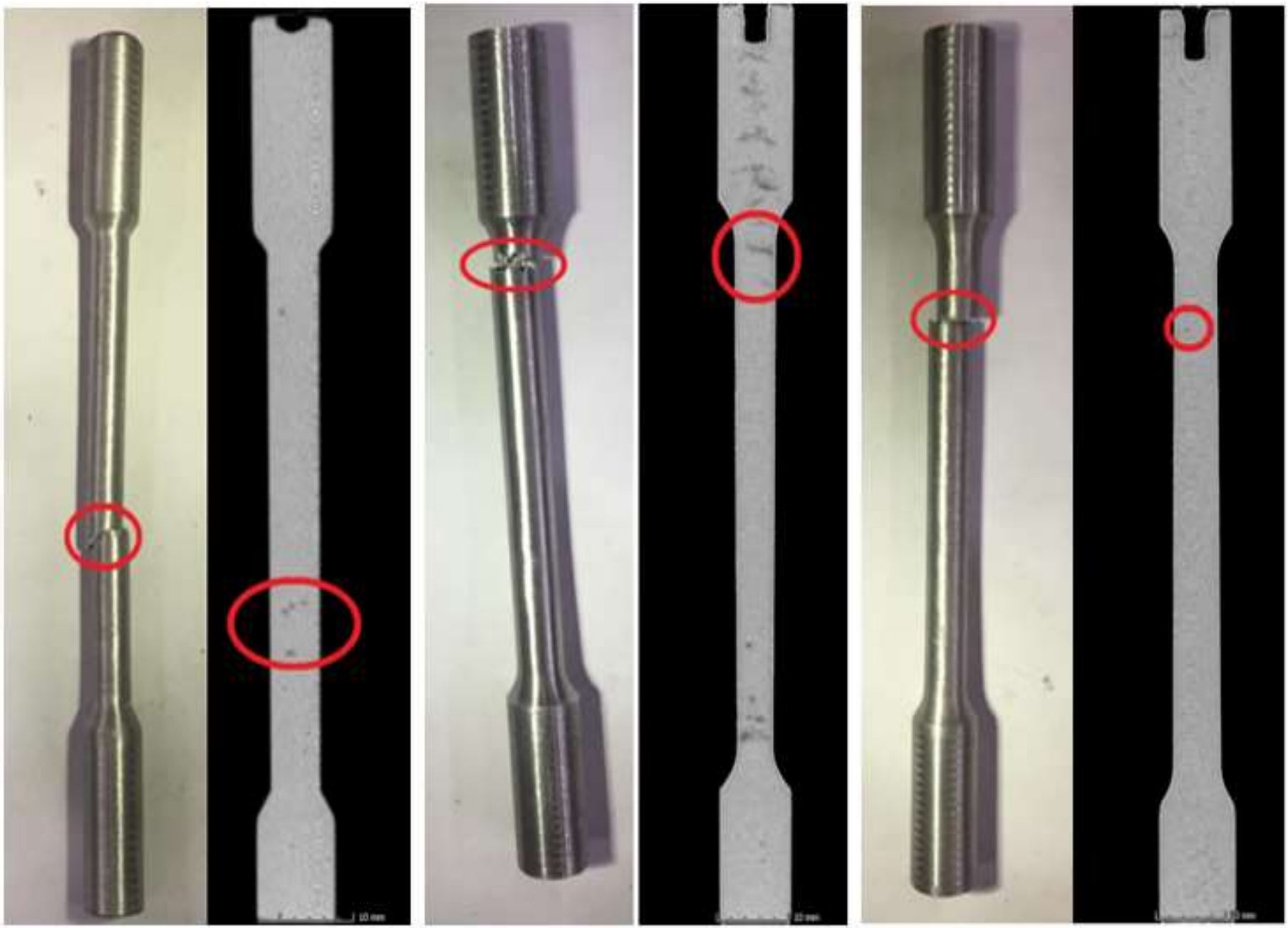
Vanadium

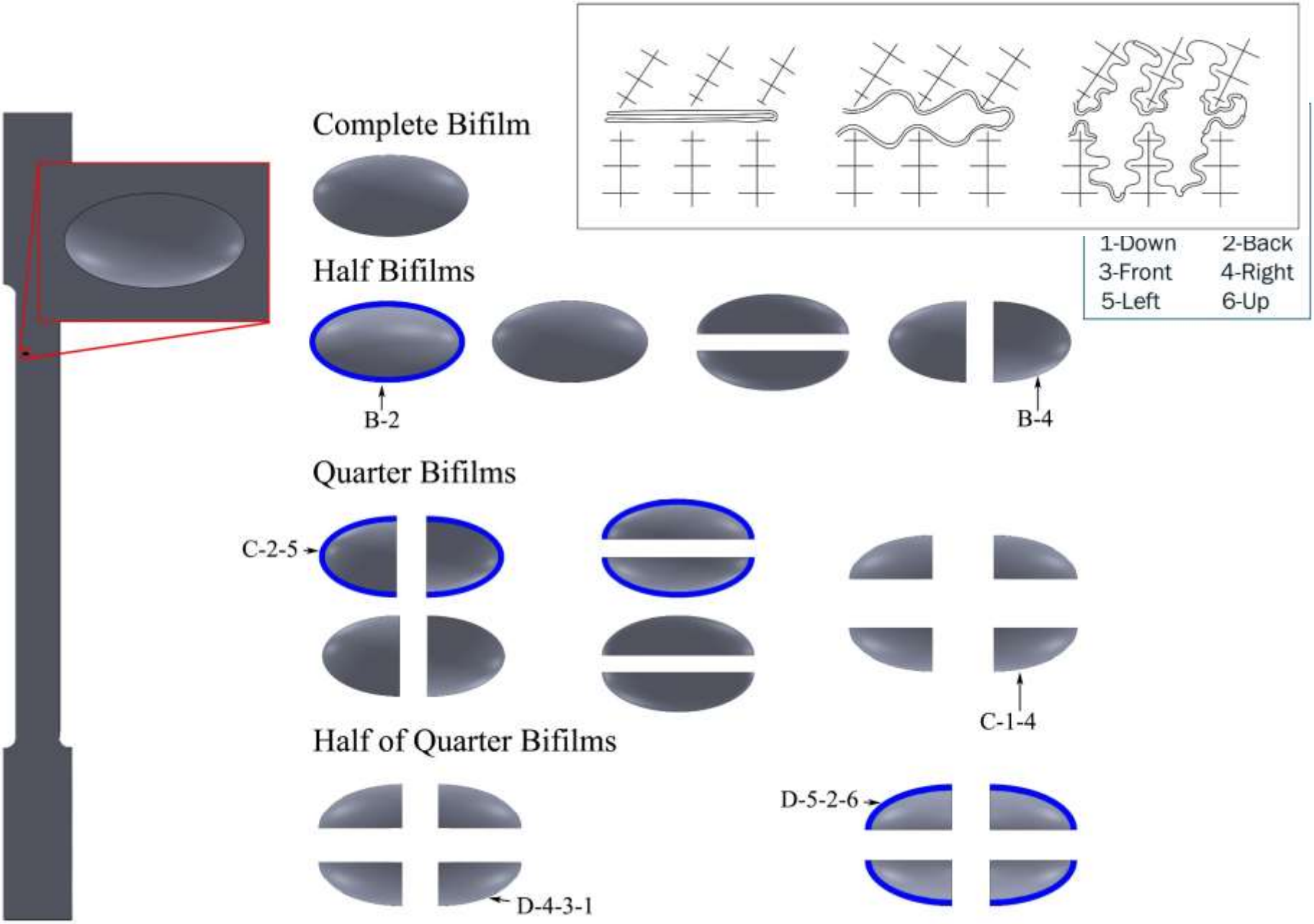
Çekme Mukavemeti-Bifilm Alanı

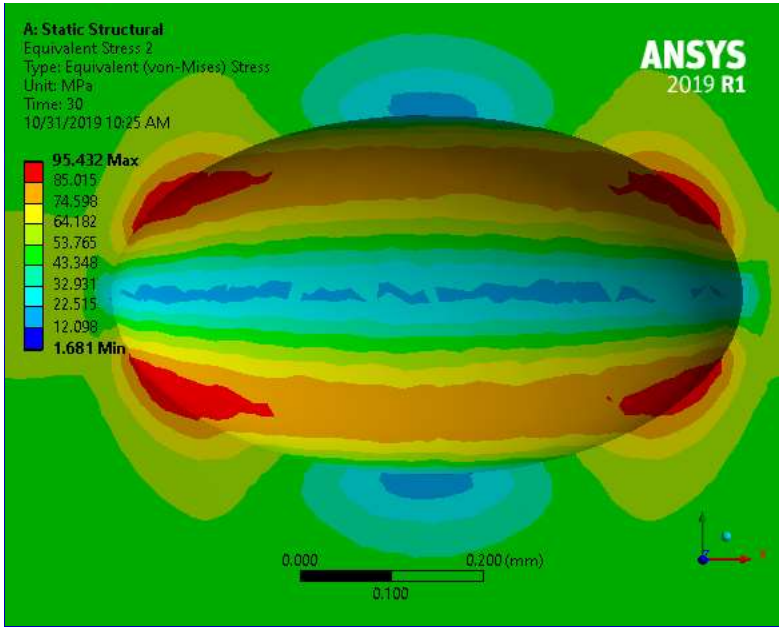


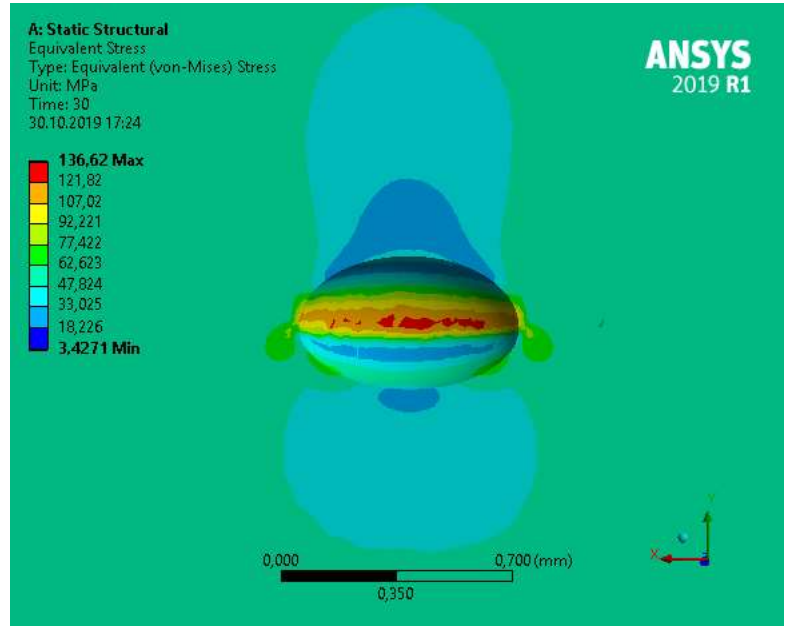

A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 30
7/2/2019 8:36 PM
73.041 Max
65.378
57.714
50.051
42.387
34.724
27.06
19.397
11.733
4.0695 Min
ANSYS
2019 R1
0.000
1.000 (mm)
0.500
A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 30
9/18/2019 2:35 PM
173.37 Max
155.01
136.65
118.28
99.919
81.555
63.191
44.827
26.463
8.0987 Min
ANSYS
2019 R1
0.000
1.500
A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 30
9/19/2019 12:24 PM
172.7 Max
154.41
136.13
117.84
99.556
81.271
62.986
44.701
26.416
8.1308 Min
ANSYS
2019 R1
0.000
2.500
A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 30
9/20/2019 4:55 PM
178.46 Max
159.52
140.58
121.64
102.71
83.768
64.83
45.893
26.955
8.0177 Min
ANSYS
2019 R1
0.000
4.500

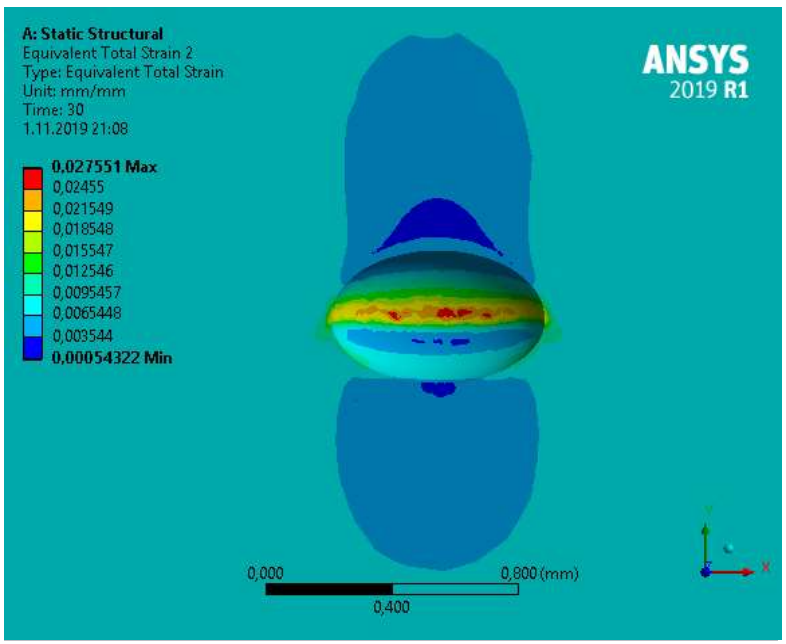

Contour Plot of Occurrred Stress(MPa) vs Applied Stress(MPa), Area
Applied Stress(MPa)
120
100
80
60
40
20
1
2
3
4
5
6
7
8
9
Area
Occurrred Stress(MPa)
< 50
50 – 100
100 – 150
150 – 200
> 200

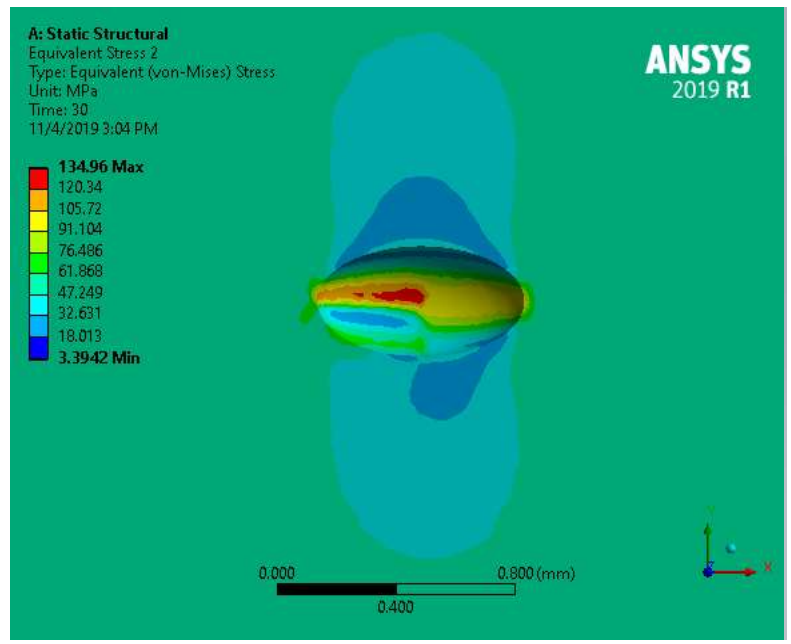


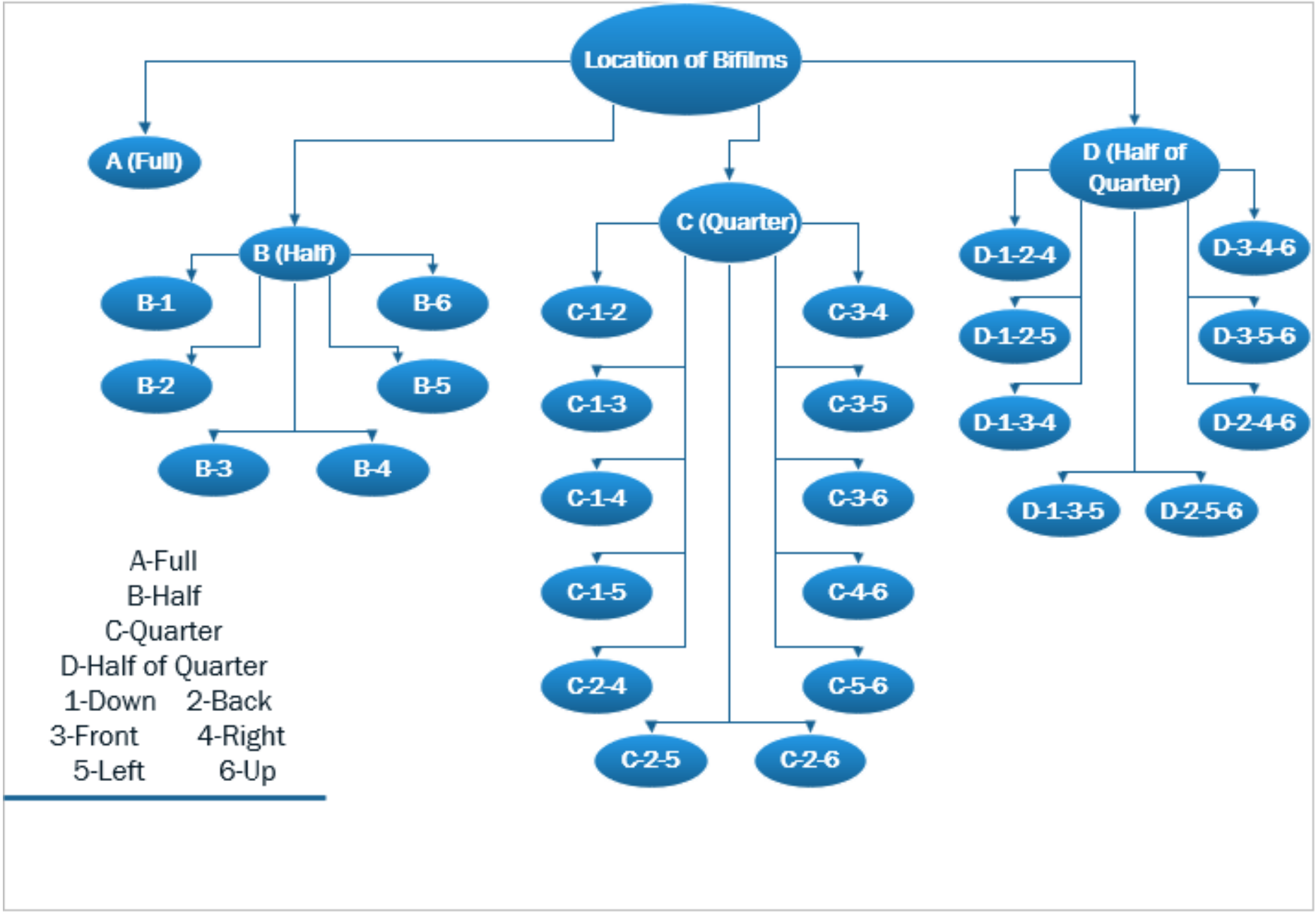

Complete Bifilm
Half Bifilms
B-2
B-4
Quarter Bifilms
C-2-5
C-1-4
Half of Quarter Bifilms
D-5-2-6
D-4-3-1
1-Down
2-Back
3-Front
4-Right
5-Left
6-Up

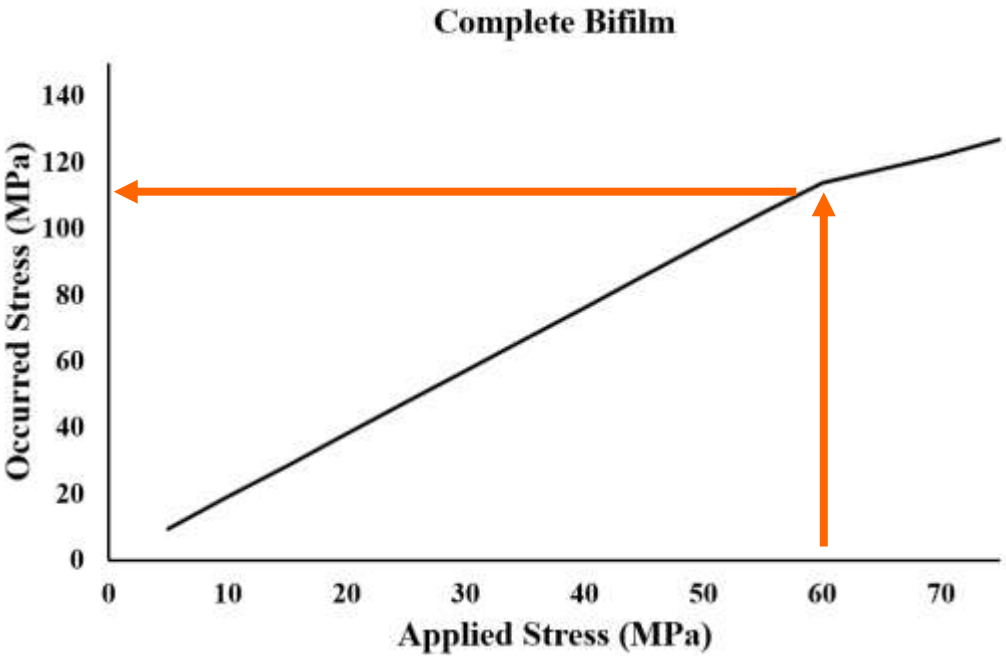

A: Static Structural
Equivalent Stress 2
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 30
10/31/2019 10:25 AM
95.432 Max
85.015
74.598
64.182
53.765
43.348
32.931
22.515
12.098
1.681 Min
ANSYS
2019 R1
0.000
0.200 (mm)
0.100

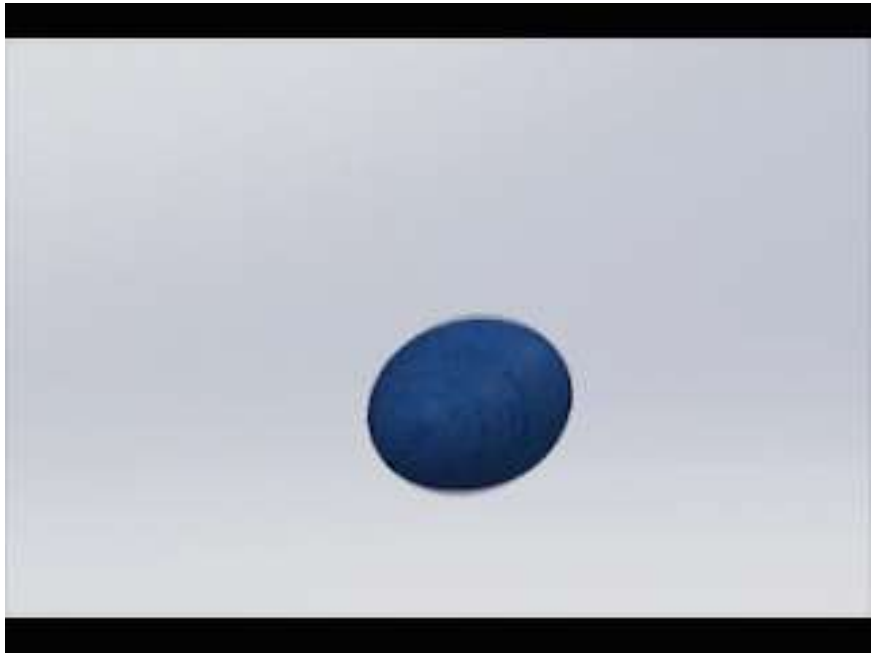

A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 30
30.10.2019 17:24
136,62 Max
121,82
107,02
92,221
77,422
62,623
47,824
33,025
18,226
3.4271 Min
ANSYS
2019 R1
0,000
0,700 (mm)
0,350

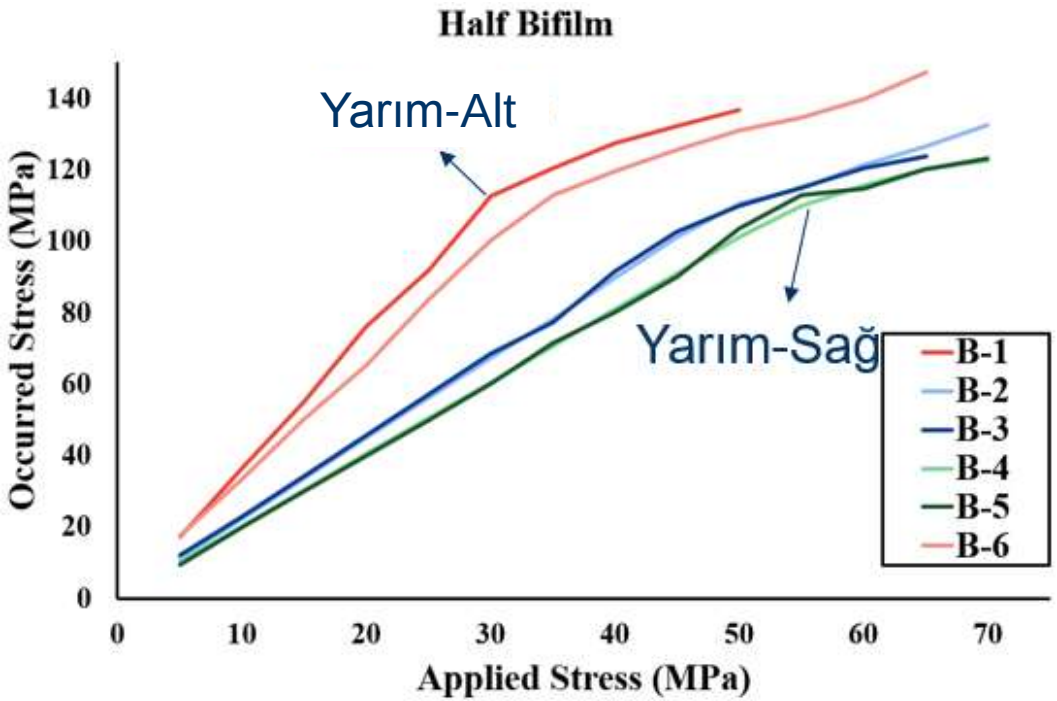

A: Static Structural
Equivalent Total Strain 2
Type: Equivalent Total Strain
Unit: mm/mm
Time: 30
1.11.2019 21:08
0,027551 Max
0,02455
0,021549
0,018548
0,015547
0,012546
0,0095457
0,0065448
0,003544
0,00054322 Min
ANSYS
2019 R1
0,000
0,800 (mm)
0,400

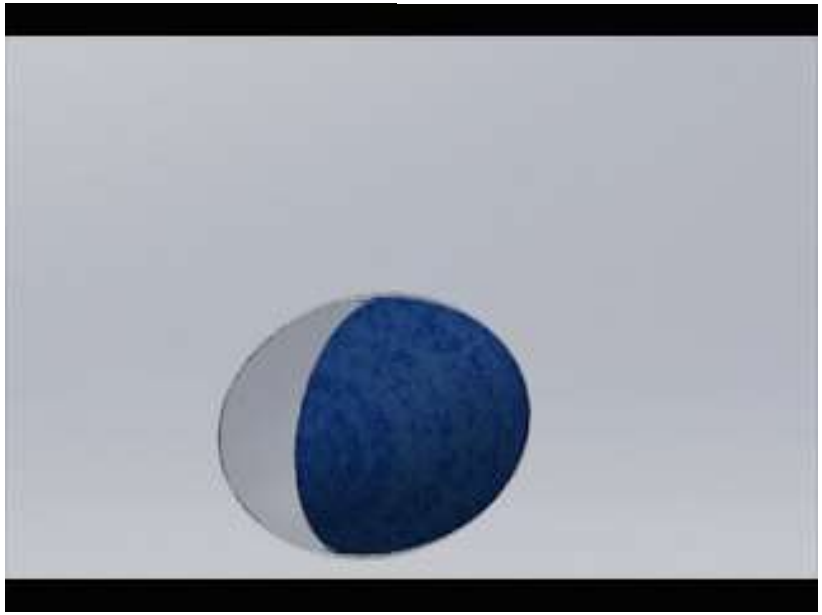

A: Static Structural
Equivalent Stress 2
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 30
11/4/2019 3:04 PM
134.96 Max
120.34
105.72
91.104
76.486
61.868
47.249
32.631
18.013
3.3942 Min
ANSYS
2019 R1
0.000
0.800 (mm)
0.400

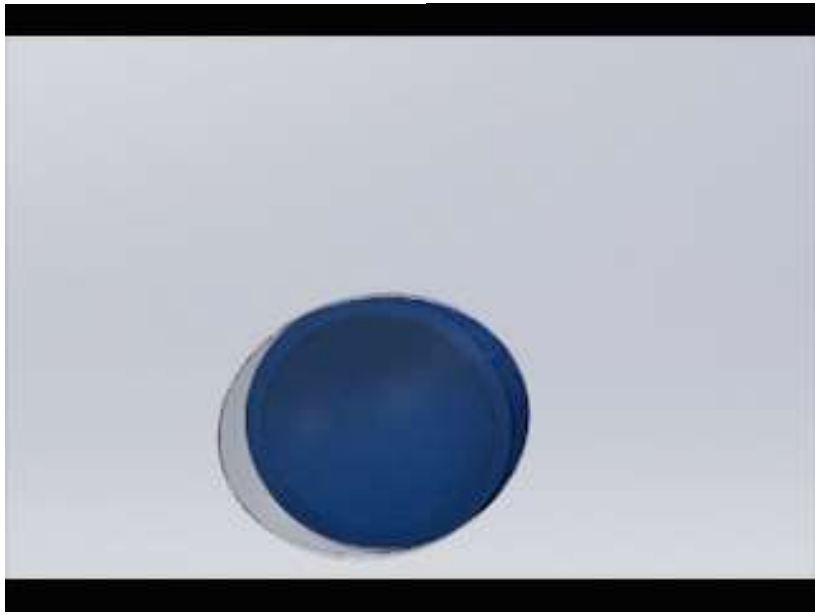

Location of Bifilms
A (Full)
B (Half)
C (Quarter)
D (Half of Quarter)
B-1
B-2
B-3
B-4
B-5
B-6
C-1-2
C-1-3
C-1-4
C-1-5
C-2-4
C-2-5
C-2-6
C-3-4
C-3-5
C-3-6
C-4-6
C-5-6
D-1-2-4
D-1-2-5
D-1-3-4
D-1-3-5
D-2-5-6
D-3-4-6
D-3-5-6
D-2-4-6
A-Full
B-Half
C-Quarter
D-Half of Quarter
1-Down 2-Back
3-Front 4-Right
5-Left 6-Up

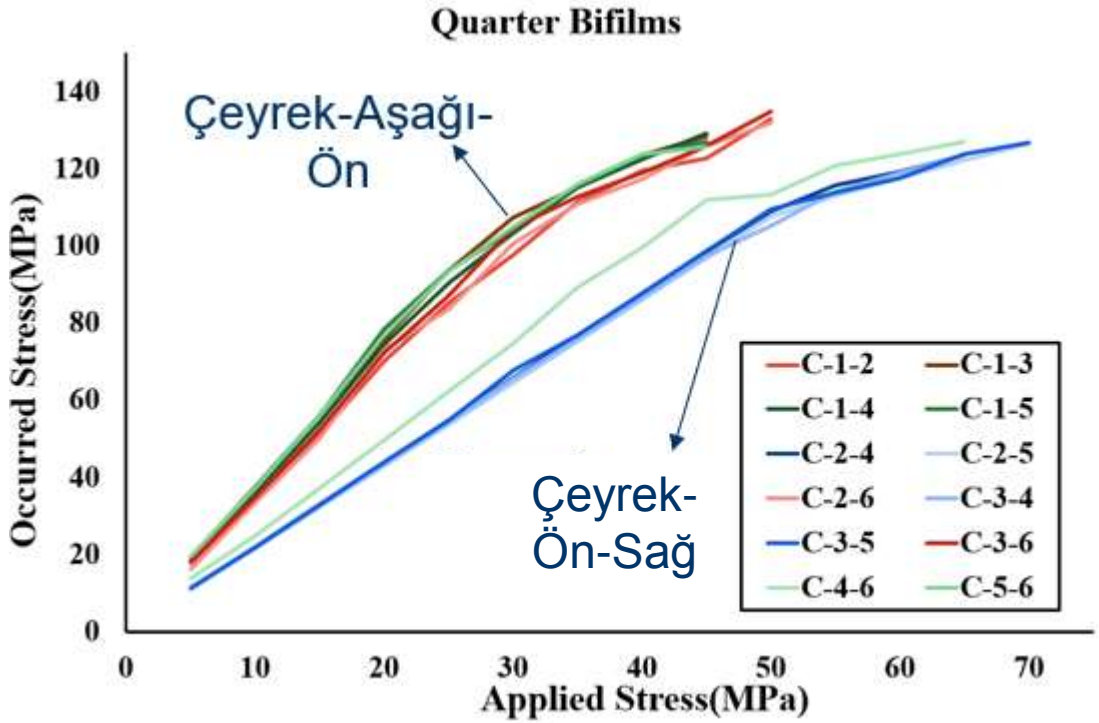

Complete Bifilm
Occurred Stress (MPa)
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
Applied Stress (MPa)

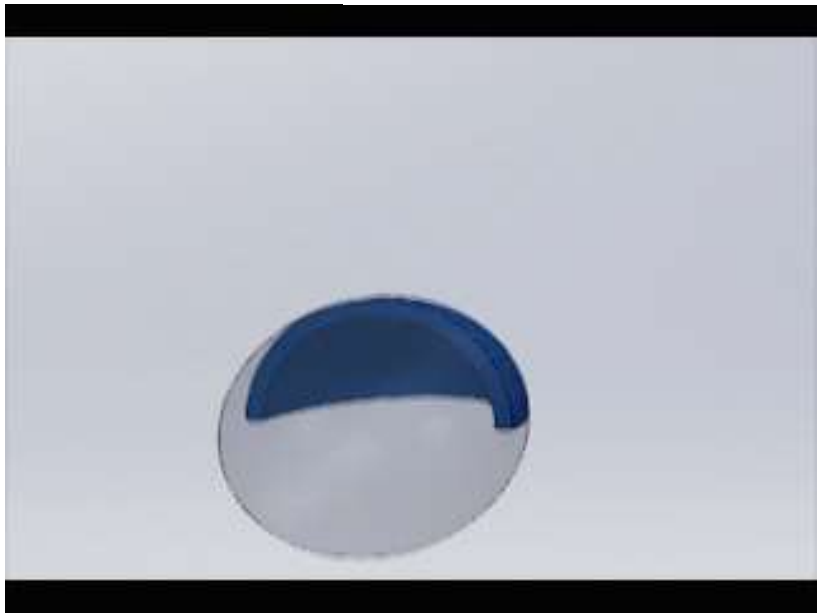


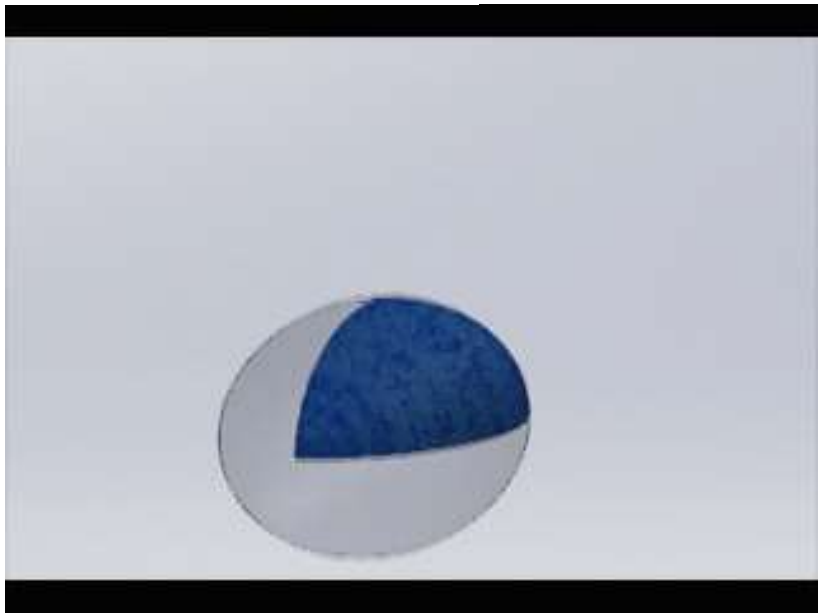

Half Bifilm
Yarım-Alt
Yarım-Sağ
B-1
B-2
B-3
B-4
B-5
B-6
Occurred Stress (MPa)
Applied Stress (MPa)
0
20
40
60
80
100
120
140
0
10
20
30
40
50
60
70

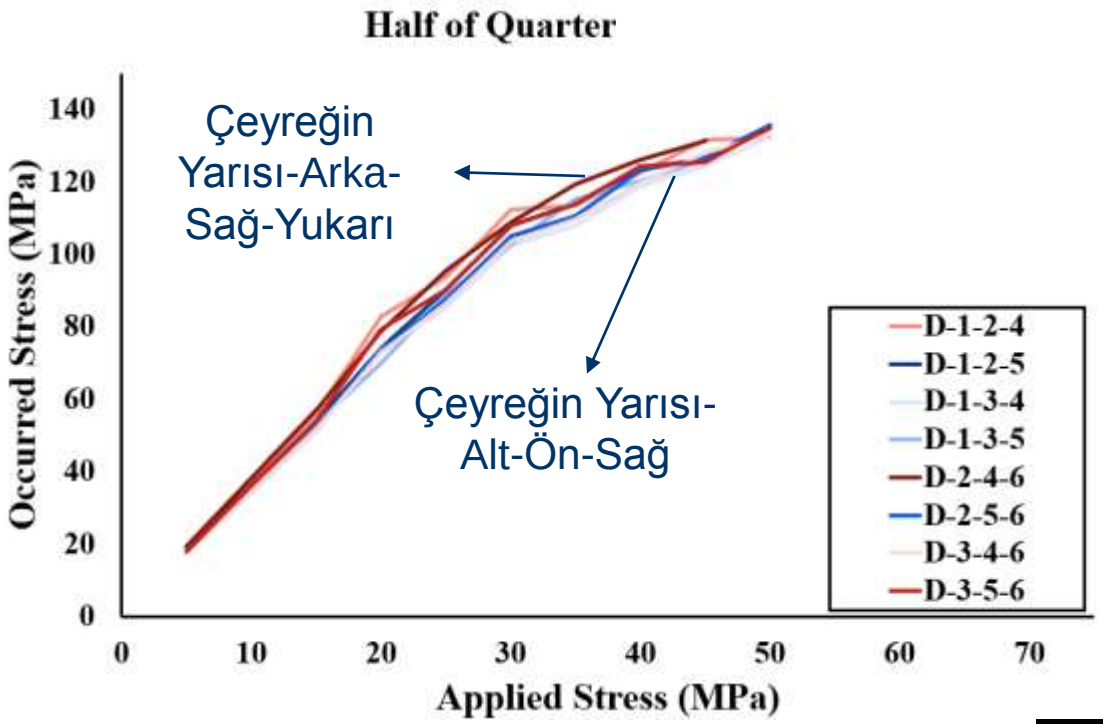


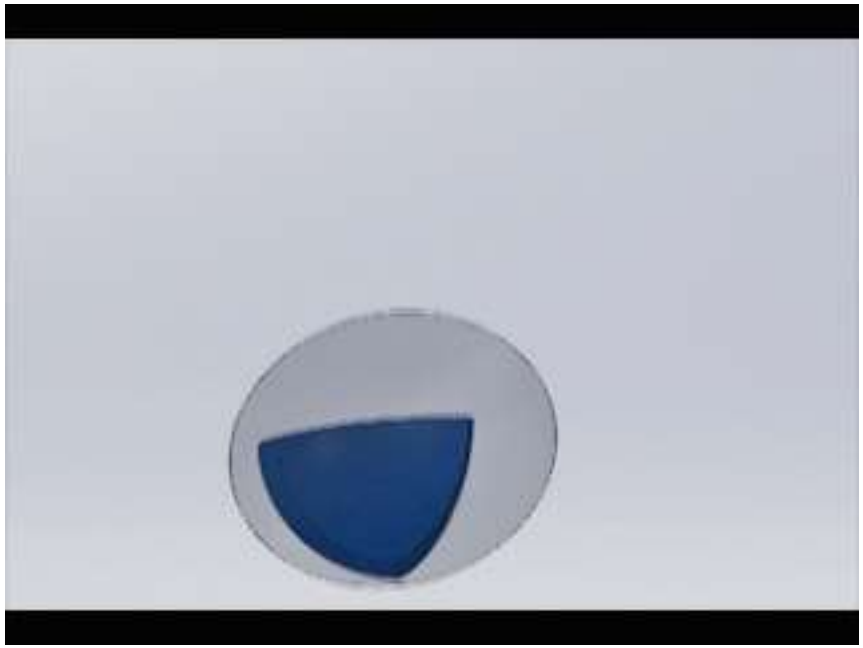


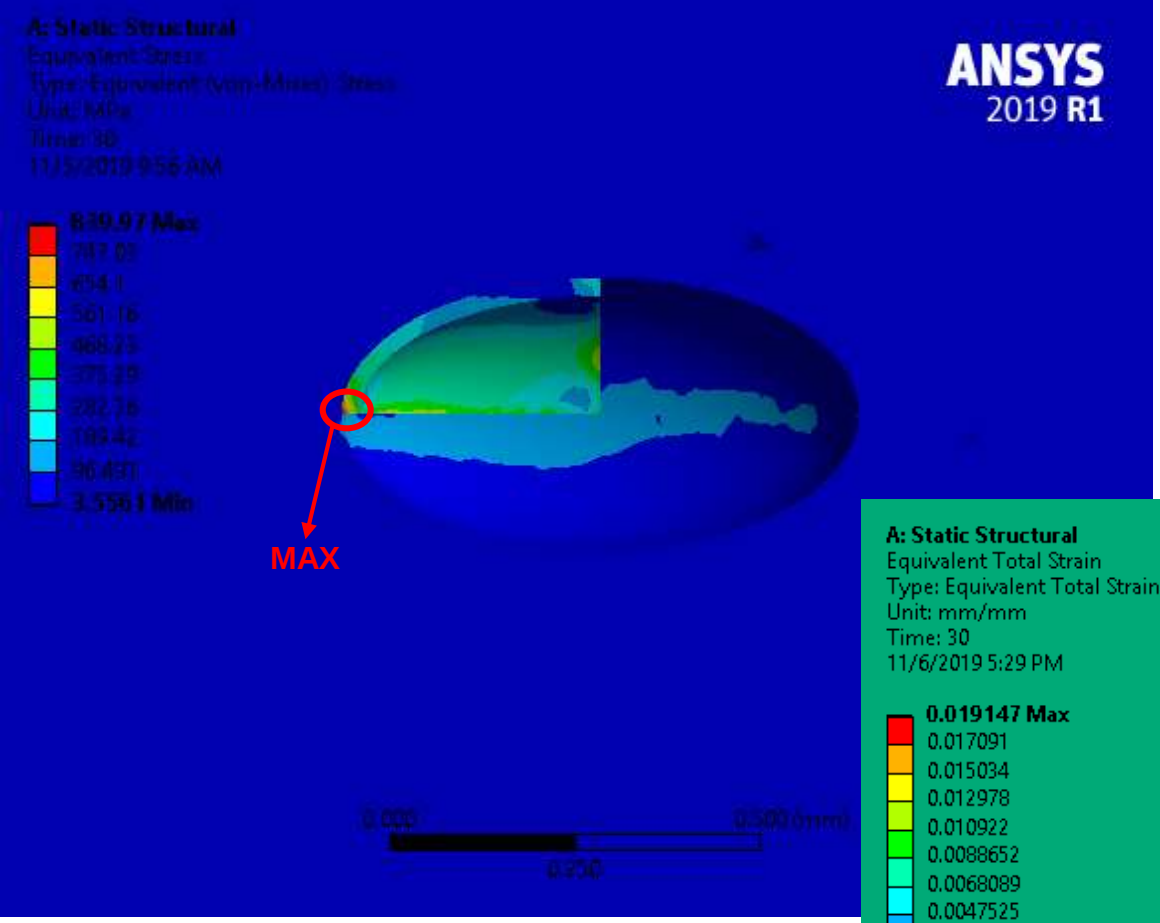

Quarter Bifilms
Occurred Stress(MPa)
Applied Stress(MPa)
0
20
40
60
80
100
120
140
0
10
20
30
40
50
60
70
Çeyrek-Aşağı-Ön
Çeyrek-Ön-Sağ
C-1-2
C-1-3
C-1-4
C-1-5
C-2-4
C-2-5
C-2-6
C-3-4
C-3-5
C-3-6
C-4-6
C-5-6

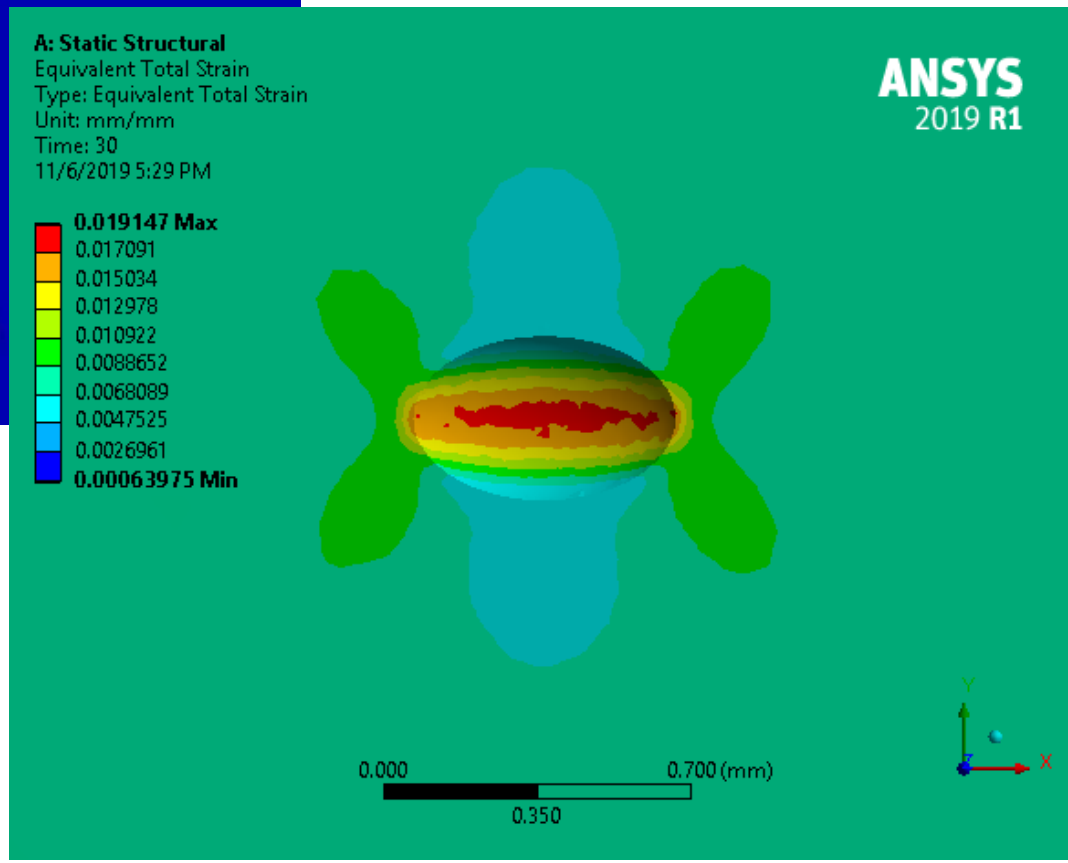





Half of Quarter
Occurred Stress (MPa)
Applied Stress (MPa)
0
20
40
60
80
100
120
140
0
10
20
30
40
50
60
70
Çeyreğin Yarısı-Arka-Sağ-Yukarı
Çeyreğin Yarısı-Alt-Ön-Sağ
D-1-2-4
D-1-2-5
D-1-3-4
D-1-3-5
D-2-4-6
D-2-5-6
D-3-4-6
D-3-5-6




ANSYS
2019 R1
MAX


A: Static Structural
Equivalent Total Strain
Type: Equivalent Total Strain
Unit: mm/mm
Time: 30
11/6/2019 5:29 PM
0.019147 Max
0.017091
0.015034
0.012978
0.010922
0.0088652
0.0068089
0.0047525
0.0026961
0.00063975 Min
ANSYS
2019 R1
0.000
0.700 (mm)
0.350
Y
X

Sonuçlar

- Porozite boyutunun ve konumunun mekanik özellikler üzerinde önemli bir etkisi vardır.

- Önemli olan bifilmin boyutu, şekli, sayısı ve çekme eksenine göre oryantasyonudur.

- Por boyutları ve sayıları ile mekanik özellikler arasında analitik bir yaklaşım kurulmuş olup potansiyel kırılma noktası bir çekme çubuğunun CT Scan taramasına bakılarak belirlenebilicektir.

Teşekkürler