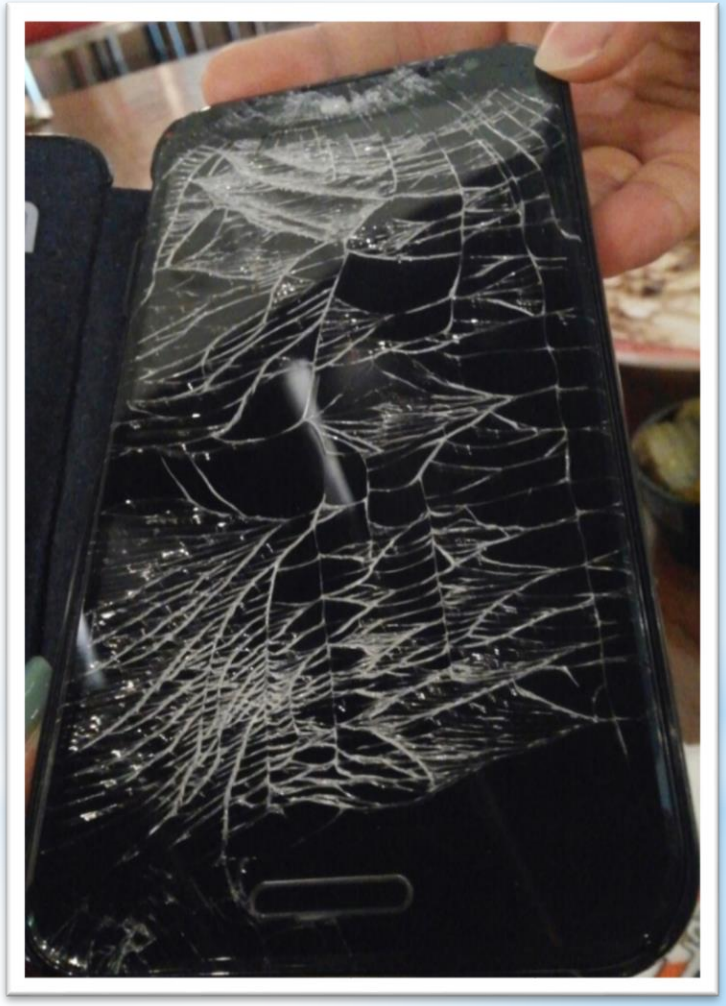
* 휴대폰 액정에 가해지는 응력에 따른 파괴 모양 분석

미래자동차공학과

조계환

*목표

*휴대폰 액정 맨 위의 가운데 부분에
파괴응력 이상의 응력이
주어질 경우 어떤 모양으로 파괴가
이루어지는지 분석하여 실제로
파괴가 일어난 휴대폰
액정과 비교



*계획

*휴대폰과 액정의 material property를 최대한 수집하고 COMSOL을 통해 액정의 파괴를 구현

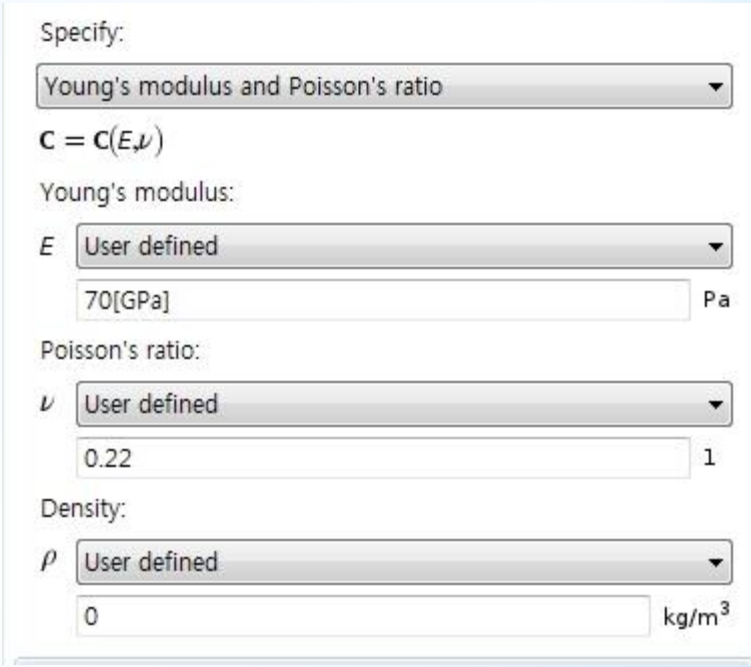
*하지만 COMSOL에서는 파괴에 대한 직접적인 분석 TOOL이 없으므로 맨 위의 가운데 부분에 crack에 응력이 가해졌다고 가정하여 위에서 부터 차례대로 응력을 분석 휴대폰 액정 전체의 파괴모양을 구현

*property

Material	Young's Modulus (Modulus of Elasticity) - E -		Ultimate Tensile Strength - S_u -	Yield Strength - S_y -
	(10^6 psi)	(10^9 N/m^2, GPa)	(10^6 N/m^2, MPa)	(10^6 N/m^2, MPa)
ABS plastics		2.3	40	
Acrylic		3.2	70	
Aluminum	10.0	69	110	95
Aluminium Bronze		120		
Antimony	11.3			
Aramid		70 - 112		
Beryllium (Be)	42	287		
Bismuth	4.6			
Bone		9	170 (compression)	
Boron				3100
Brass		102 - 125	250	
Brass, Naval		100		
Bronze		96 - 120		
Cadmium	4.6			
Carbon Fiber Reinforced Plastic		150		
Cast Iron 4.5% C, ASTM A-48			170	
Chromium	36			
Cobalt	30			
Concrete, High Strength (compression)		30	40 (compression)	
Copper	17	117	220	70
Diamond (C)		1220		
Douglas fir Wood		13	50 (compression)	
Fiberboard, Medium Density		4		
Flax fiber		58		
Glass		50 - 90	50 (compression)	

*property

Material	Poisson's Ratio
Upper limit	0.5
Aluminum	0.334
Aluminum, 6061-T6	0.35
Aluminum, 2024-T4	0.32
Beryllium Copper	0.285
Brass, 70-30	0.331
Brass, cast	0.357
Bronze	0.34
Concrete	0.1 - 0.2
Copper	0.355
Cork	0
Glass, Soda	0.22
Glass, Float	0.2 - 0.27
Granite	0.2 - 0.3
Ice	0.33
Inconel	0.27 - 0.38
Iron, Cast - gray	0.211



*가정

*농구공 700g

*8m/s -> -2m/s

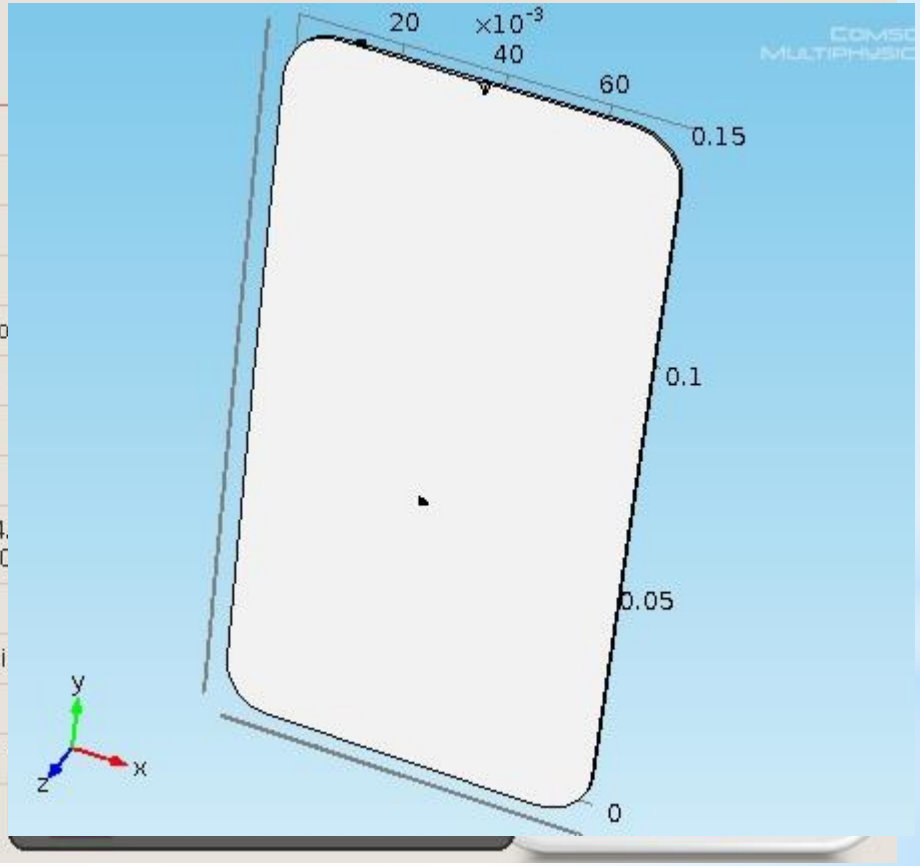
*t=0.1

*F=70N -> 50N

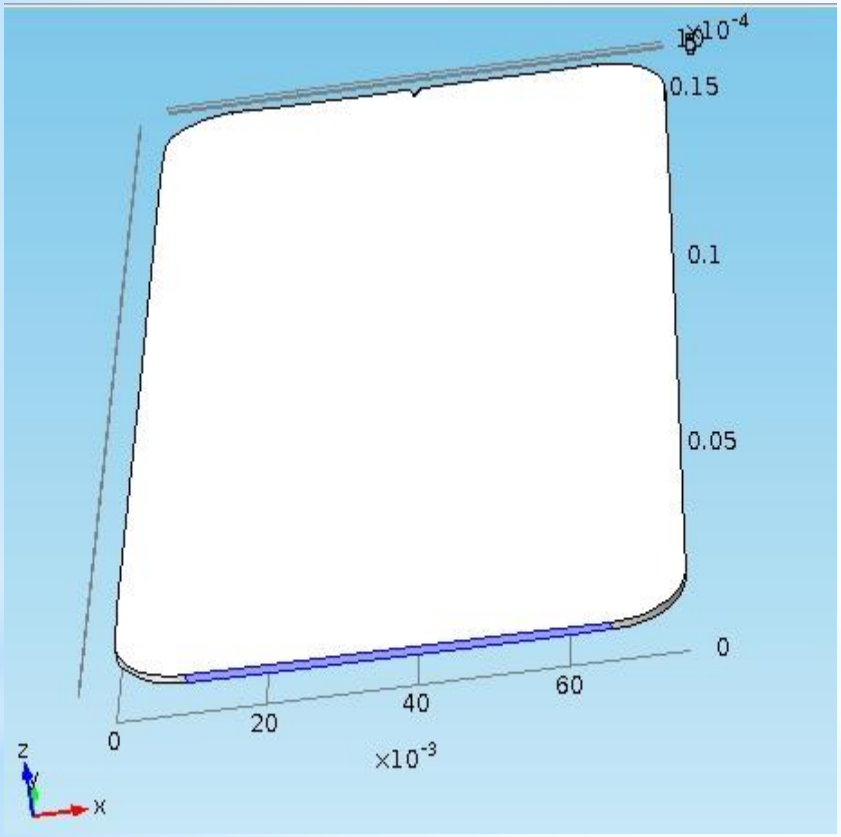
*geometry

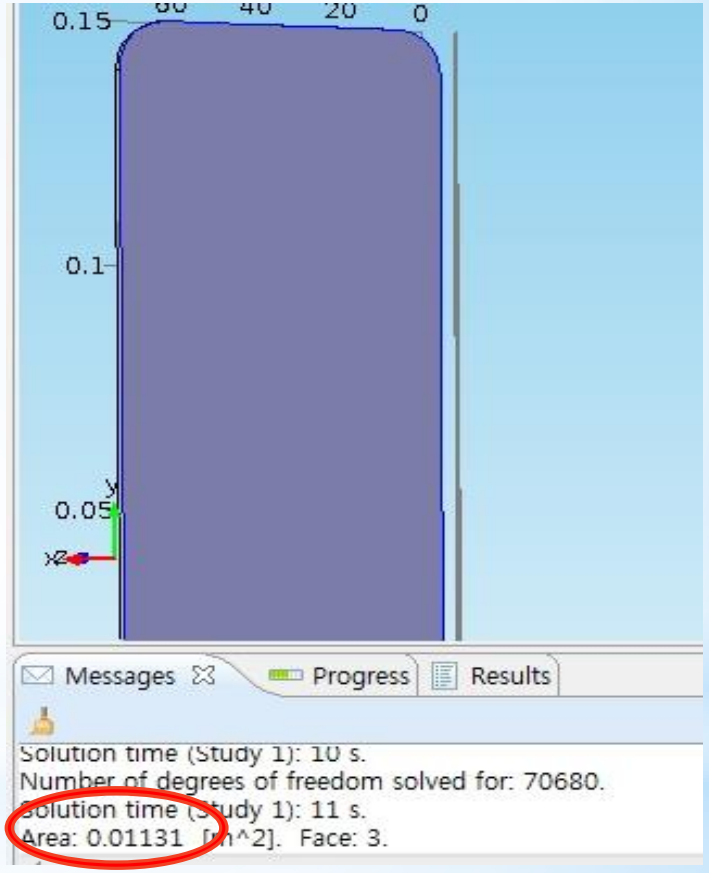
SPECIFICATION

크기	150.2 × 76.1 × 9.4 mm
무게	172g
네트워크	3G HSPA+ / EVDO Rev.A / 4G LTE
CPU	1.7GHz Quadcore Snapdragon 600
메모리	32GB eMMC + 2GB LPDDR2, Micro-SD Slo
디스플레이	138.7mm (1920×1080) Full HD IPS Display
카메라	13MP AF Camera / (전면) 2.1MP
배터리	3,140mAh 착탈식
Connectivity	Wi-Fi / Wi-Fi Direct (802.11 a/b/g/n), BT 4. cast, SlimPort (HDMI & RGB 지원), USB 2.0
OS	Android 4.1 (Jelly Bean)
색상	루나 화이트(Lunar White), 인디고 블랙(Indi
비디오 코덱	MPEG-4, H.263, H.264, DIVX, WMV
오디오 코덱	AAC, AMR, MP3, MID, WAV, WMA
지원 통신사	SKT KT LG U+



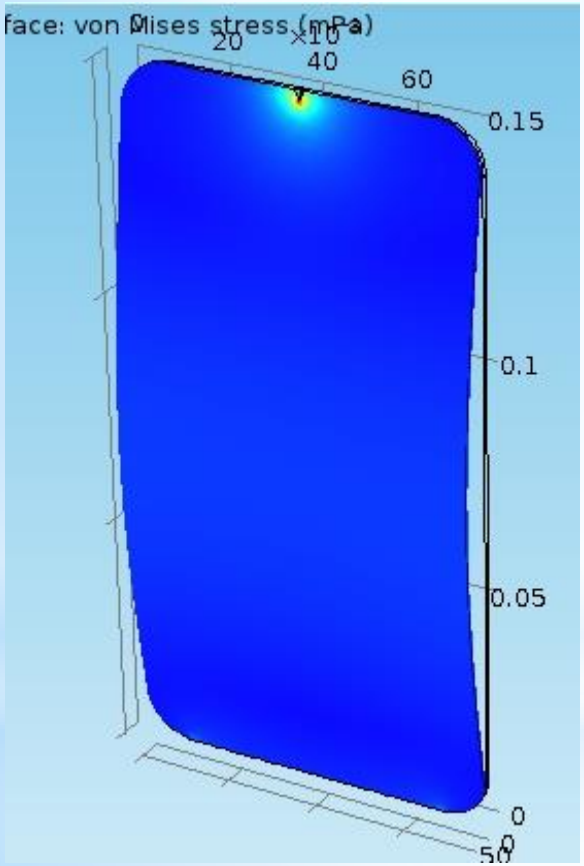
*첫 충격

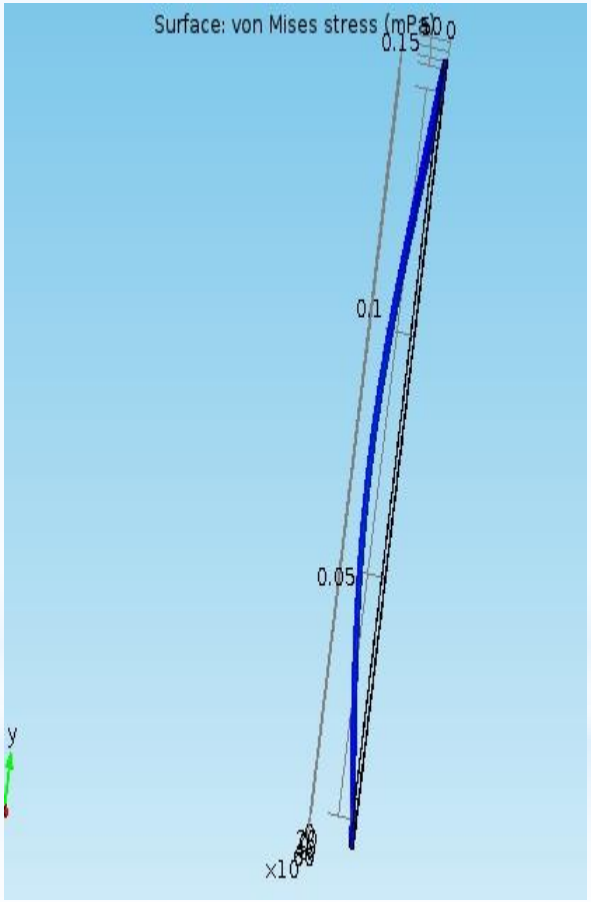


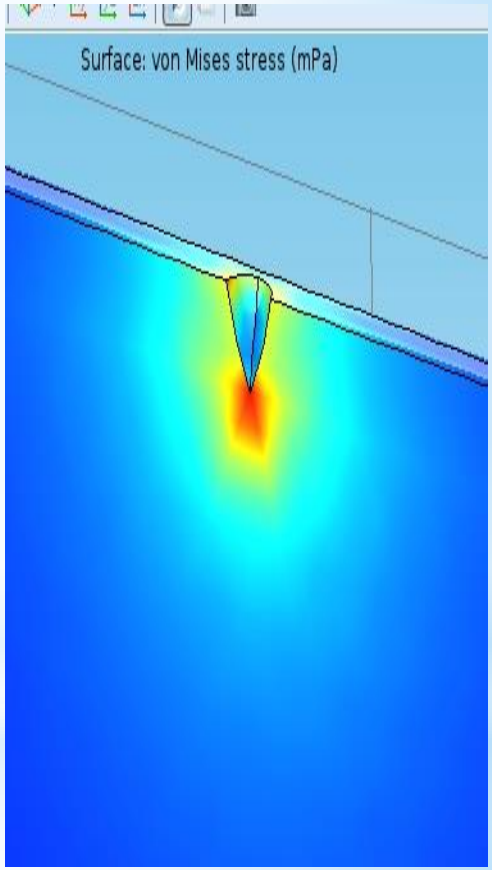


50N/0.01131m^2=4420N/m^2

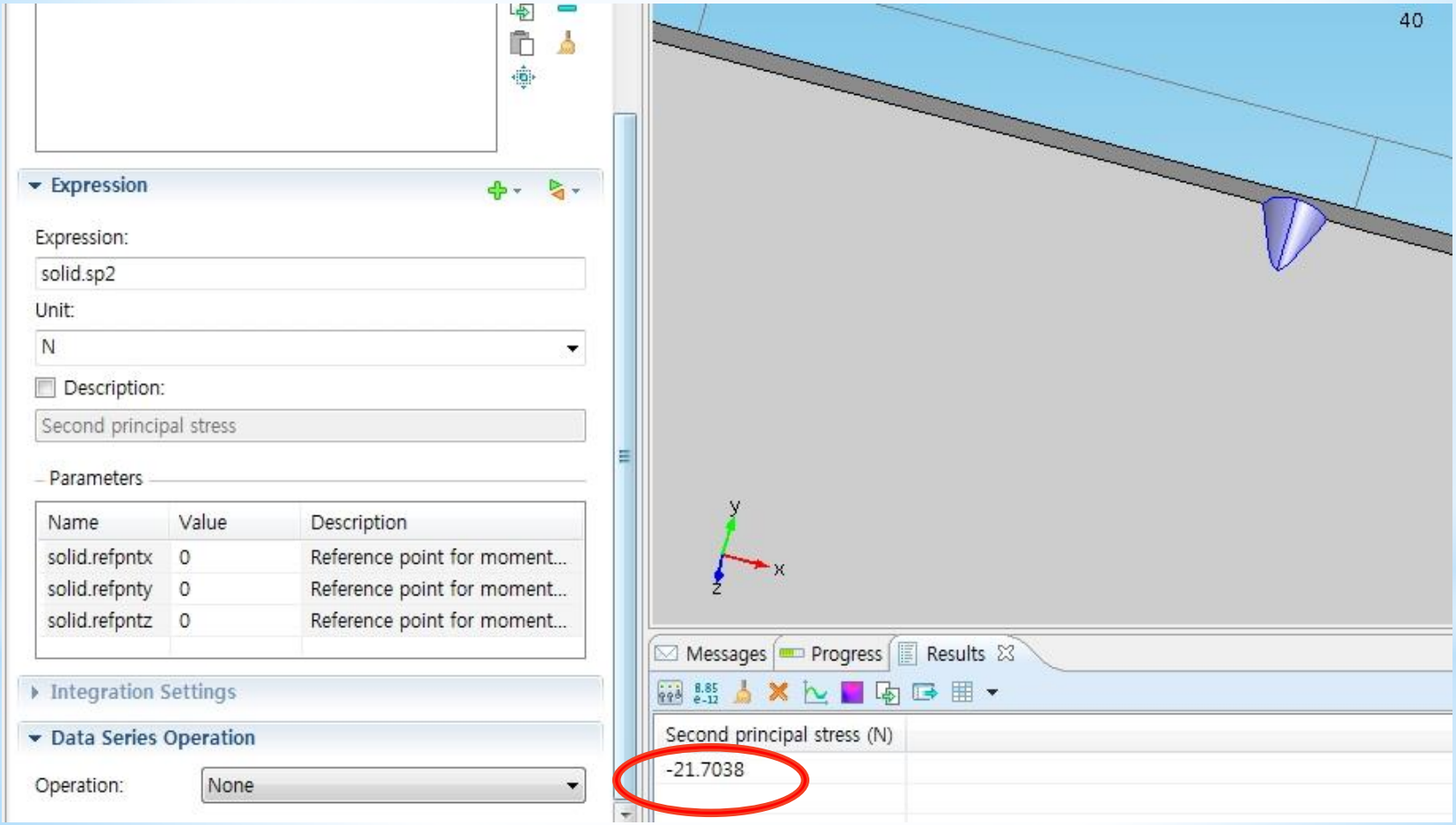
*분포


face: von Mises stress (mPa)
20
40
60
0.15
0.1
0.05
0

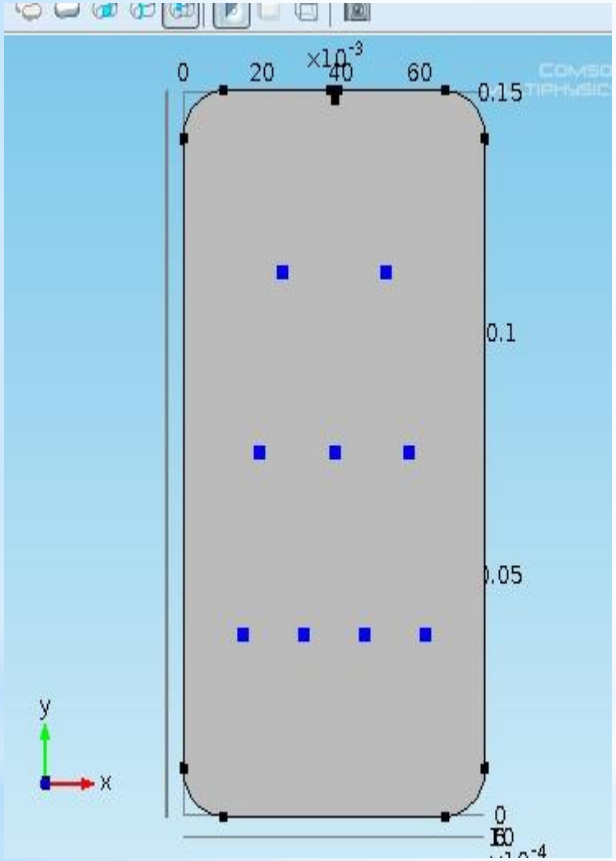

Surface: von Mises stress (mPa)
0.15
0.1
0.05
y

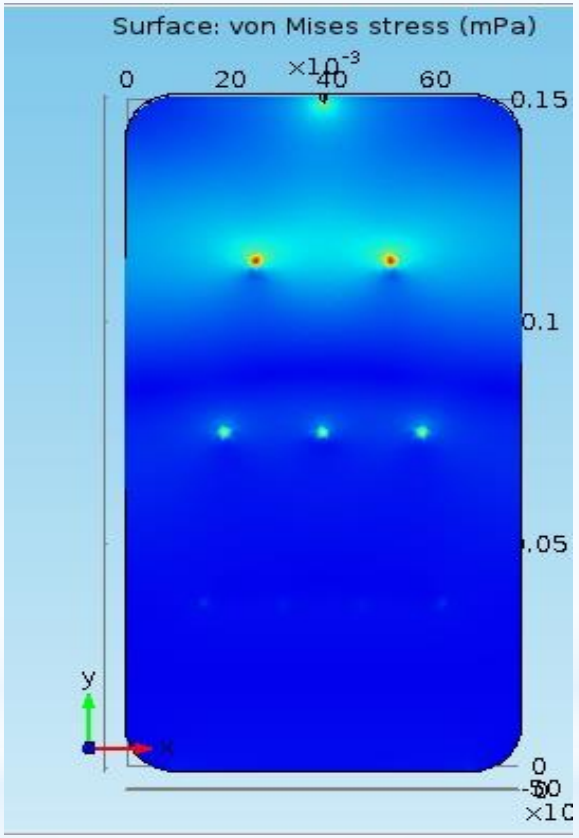

Surface: von Mises stress (mPa)

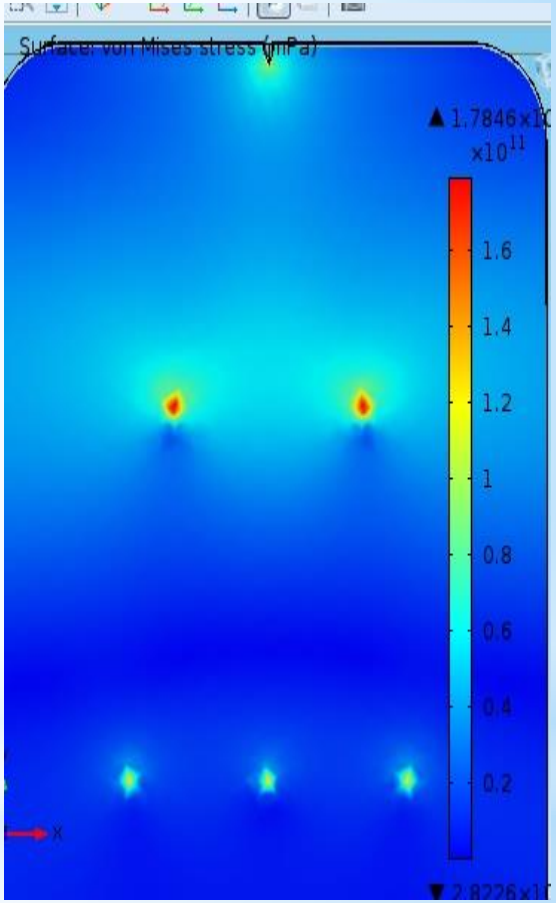
*집중 응력


Expression
Expression:
solid.sp2
Unit:
N
Description:
Second principal stress
Parameters
Name
Value
Description
solid.refpntx
0
Reference point for moment...
solid.refpnty
0
Reference point for moment...
solid.refpntz
0
Reference point for moment...
Integration Settings
Data Series Operation
Operation:
None
40
y
x
z
Messages
Progress
Results
Second principal stress (N)
-21.7038

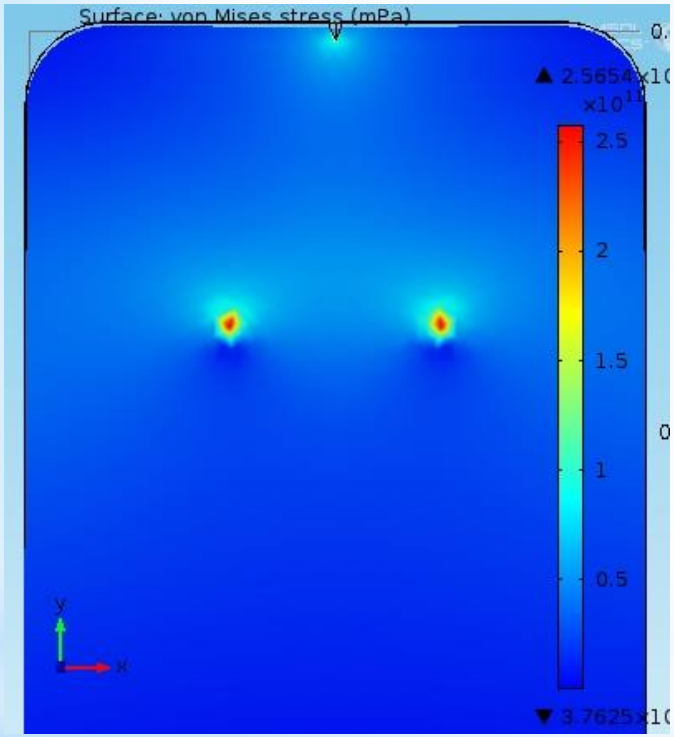
*응력분포


0
20
×10⁻³
40
60
0.15
0.1
.05
y
x


Surface: von Mises stress (mPa)
0
20
×10⁻³
40
60
0.15
0.1
.05
y
x


Surface: von Mises stress (mPa)
▲ 1.7846×10
×10¹¹
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
x

*응력 sequence

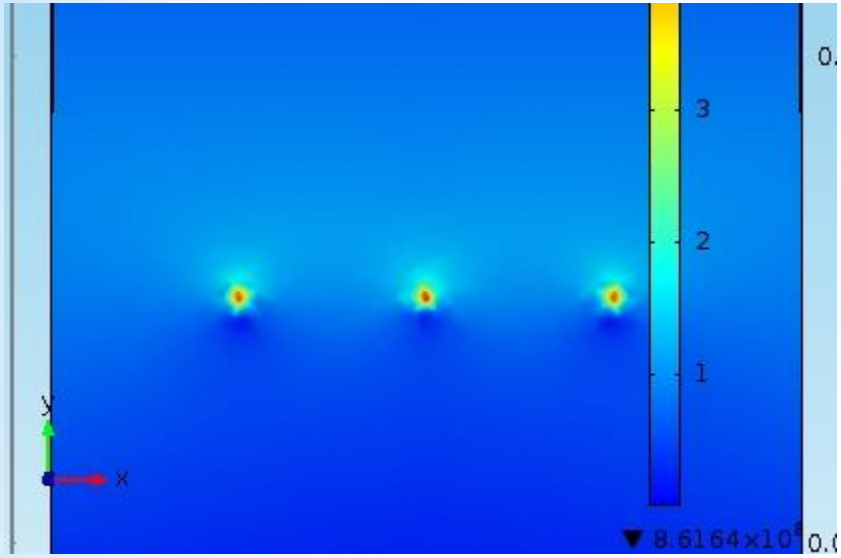


최 상단에 집중 하중을 주고

최 상단에서 37.5mm아래

두 곳을 fix했을 때의 응력

*응력

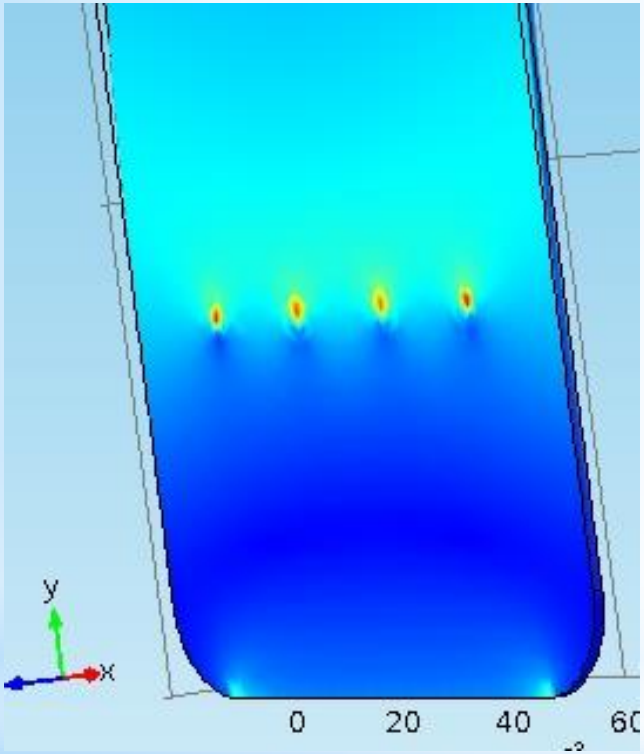


최 상단에 집중 하중을 주고

최 상단에서 **75mm**아래

세 곳을 **fix**했을 때의 응력

*응력



최 상단에 집중 하중을 주고

최 상단에서 **112.5mm**아래

네 곳을 **fix**했을 때의 응력

*비교분석