

An Investigation into the Peel Adhesion of Kapton Tape HB830

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(2nd year electronics apprentice)

Aims + Overview

- Aim: To collect repeatable data through pull tests to determine the peel force of a given adhesive.
- Peel force Vs peel angle: 90 and 180 degrees
- Peel force Vs dwell time: 1min and 24 hrs
- Peel force Vs peel rate: from 0.5 mm/min to 1100mm/min

Tape Pic and Data Sheet



Technical Data – HB830

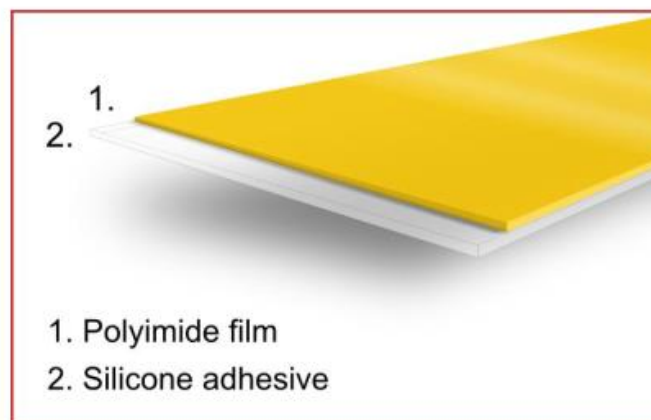


Product description

- Very high temperature resistance, excellent chemical and electrical resistance, high grade silicone adhesive, clean removable
- Excellent insulation properties
- Colour: Amber

Construction

- Polyimide film (25±2µm)
- Silicone adhesive



Technical data

Item	Unit		Spec.		Test method
Base thickness	µm	Inch	25±2	.001	ASTM D3652
Total thickness	µm	Inch	70±3	.0028	ASTM D3652
Peel strength	gf/25mm	lbf/in	600±100	1.32±0.22	ASTM D3330
Tensile strength	kg/25mm	lb/in	15~17	33~37.5	ASTM D3759
Elongation	%	-	85~95	-	ASTM D3759
Temperature resistance	°C	°F	260	500	-
Chemical resistance	-	-	Good	-	(20% HCl, NaOH / 20hrs)
Dielectric strength	kV/mm	-	98.5	-	ASTM D149
Dielectric breakdown	kV	-	6.9	-	ASTM D149
Conductivity	Ω/cm	S/m	-	-	-
Surface resistivity	Ω/sq	-	10 ¹³	-	ASTM D257

Peel Strength = 600±100 gF/25mm gained through test method ASTM D3330

ASTM D3330 Test Method

- Standard test method for peel adhesion of pressure-sensitive tape.
- Has multiple test methods for different scenarios such as different backing and single or double tapes.
- Test method A was used for 180-degree peel and method F for 90-degrees.
- 12mm tape, cleaning stainless steel plate 3x before use and 1x between tests, applied with constant pressure.
- Prepare each test within 1 minute and peel as soon as applied with minimal handling.
- Peel at 5.0 ± 0.2 mm/s (300mm/min).



Setup

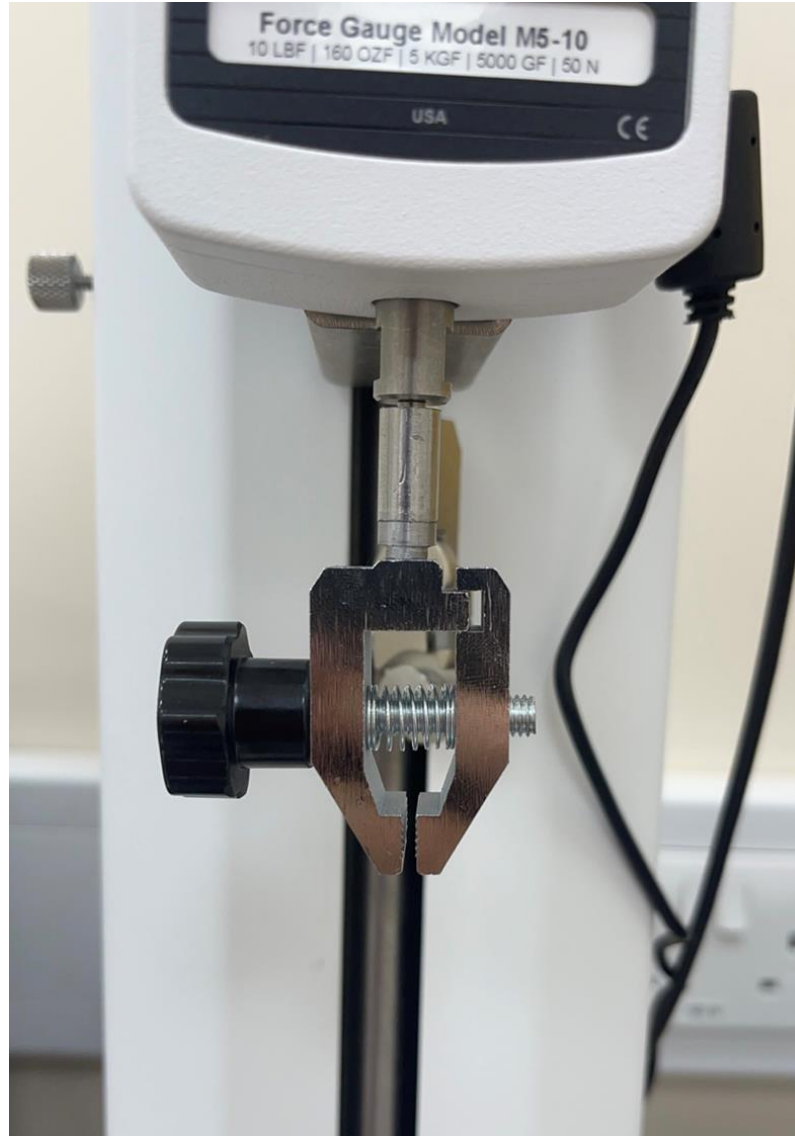
Peel Adhesion Strength at a 180-degree angle

Using:

Mark-10's ESM303
motorised test stand.

Advanced Force Gauge
M5-10.

MESUR Software.



Setup

Peel Adhesion Strength at a 90-degree angle

Using:

Mark-10's ESM303
motorised test stand.

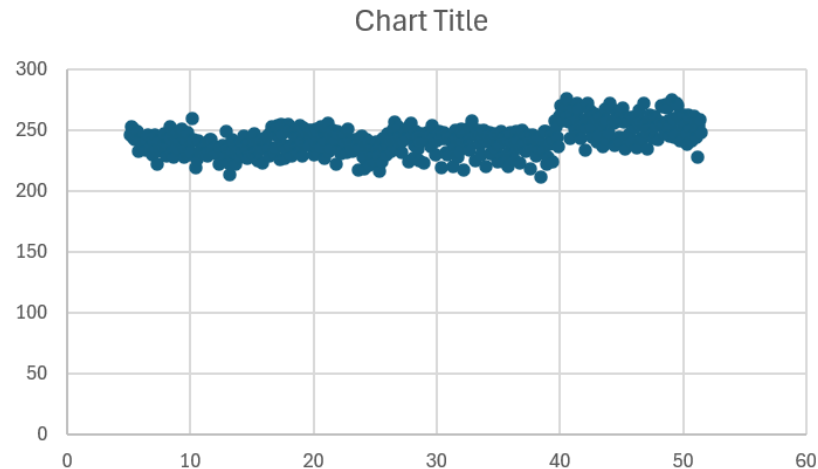
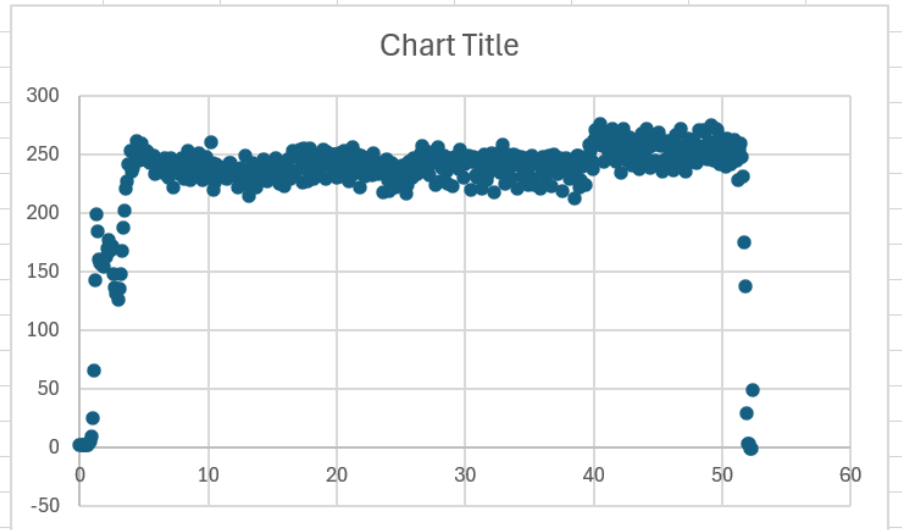
Advanced Force Gauge
M5-10.

MESUR Software.



Data analysis

	A	B	C	D	E	F	G	H	I	J	K	L
1	Reading	Load [gF]	Time [sec.]									
2	1	-2	0	2								
3	2	-2	0.1	2								
4	3	-2	0.2	2								
5	4	-2	0.3	2								
6	5	-2	0.4	2								
7	6	-2	0.5	2								
8	7	-2	0.6	2								
9	8	-4	0.7	4								
10	9	-5	0.801	5								
11	10	-9	0.901	9								
12	11	-24	1	24								
13	12	-65	1.1	65								
14	13	-142	1.202	142								
15	14	-199	1.3	199								
16	15	-184	1.401	184								
17	16	-160	1.5	160								



Data obtained from MESUR Lite Program that reads the force gauge and saves it as an Excel sheet.

Data Cleaning:

- Turn the Load(gF) into a positive value and then plot against time.
- Reject the first 52 readings and the final few readings as the force drops off due to test finishing and the gauge returning to its initial position.

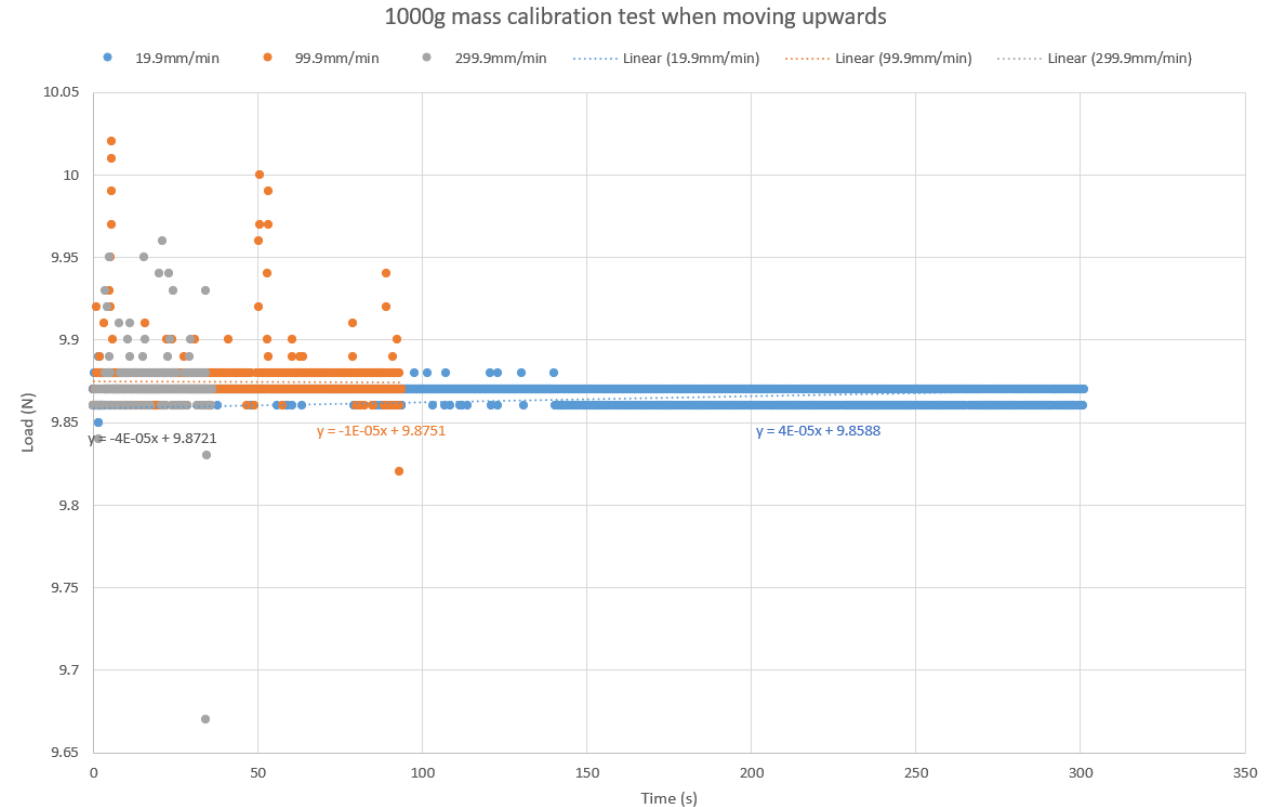
-Take an average of these readings to receive the average Load.

-Peel adhesion is given in gF/25mm. The tape used is 12mm in width. Multiply Load by (25/12) to achieve peel adhesion.

180-degree 24-hour dwell time
(1) test.

Calibrating Force Gauge Peel Tester

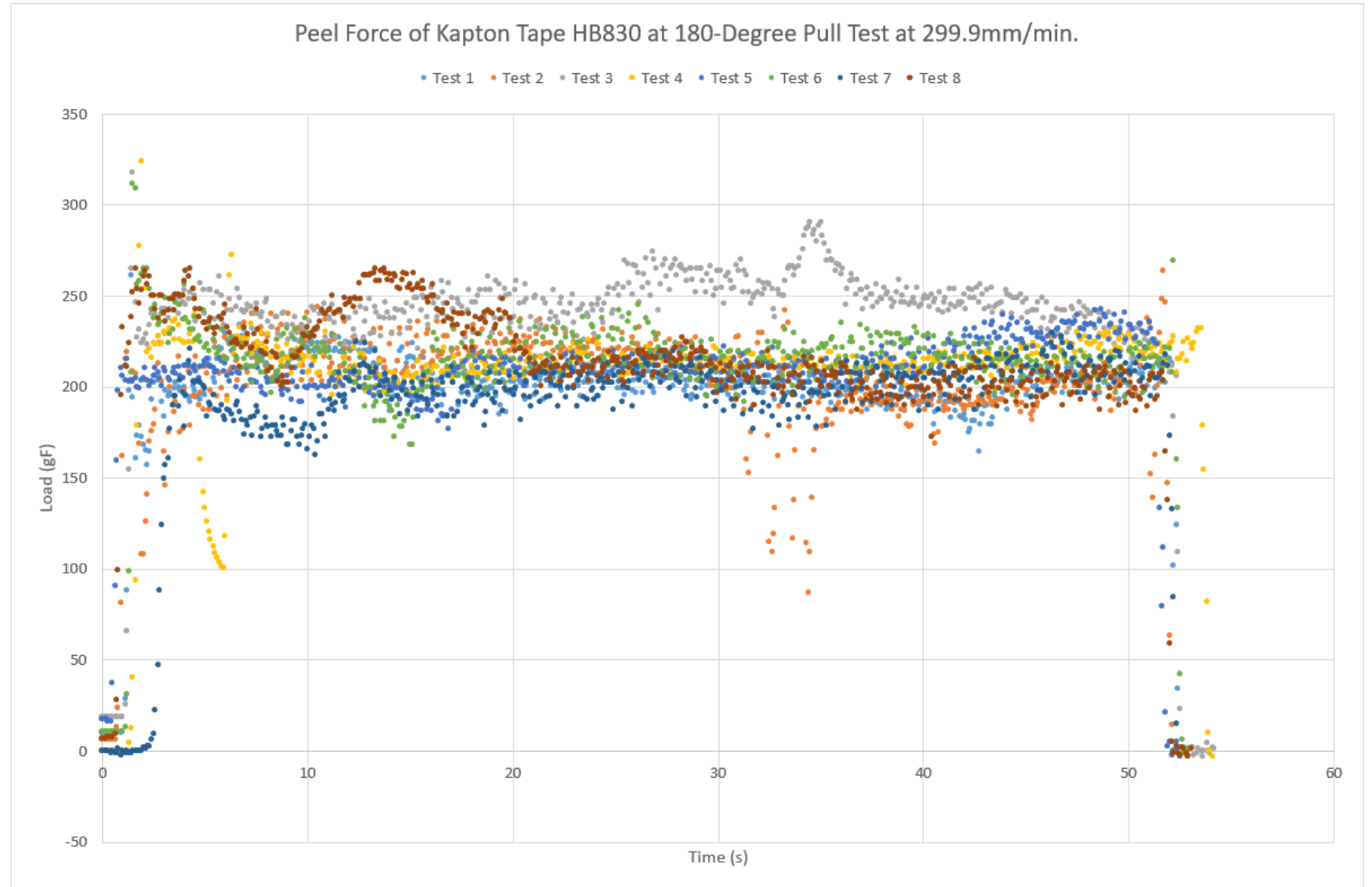
- Calibration was done by attaching measured masses to the force gauge and moving it up at a given speed to see if any variation occurred.
- All tests gave constant force with minor variation showing the force gauge is correctly calibrated.



180-Degree Peel Tests

Dwell time: 1 min

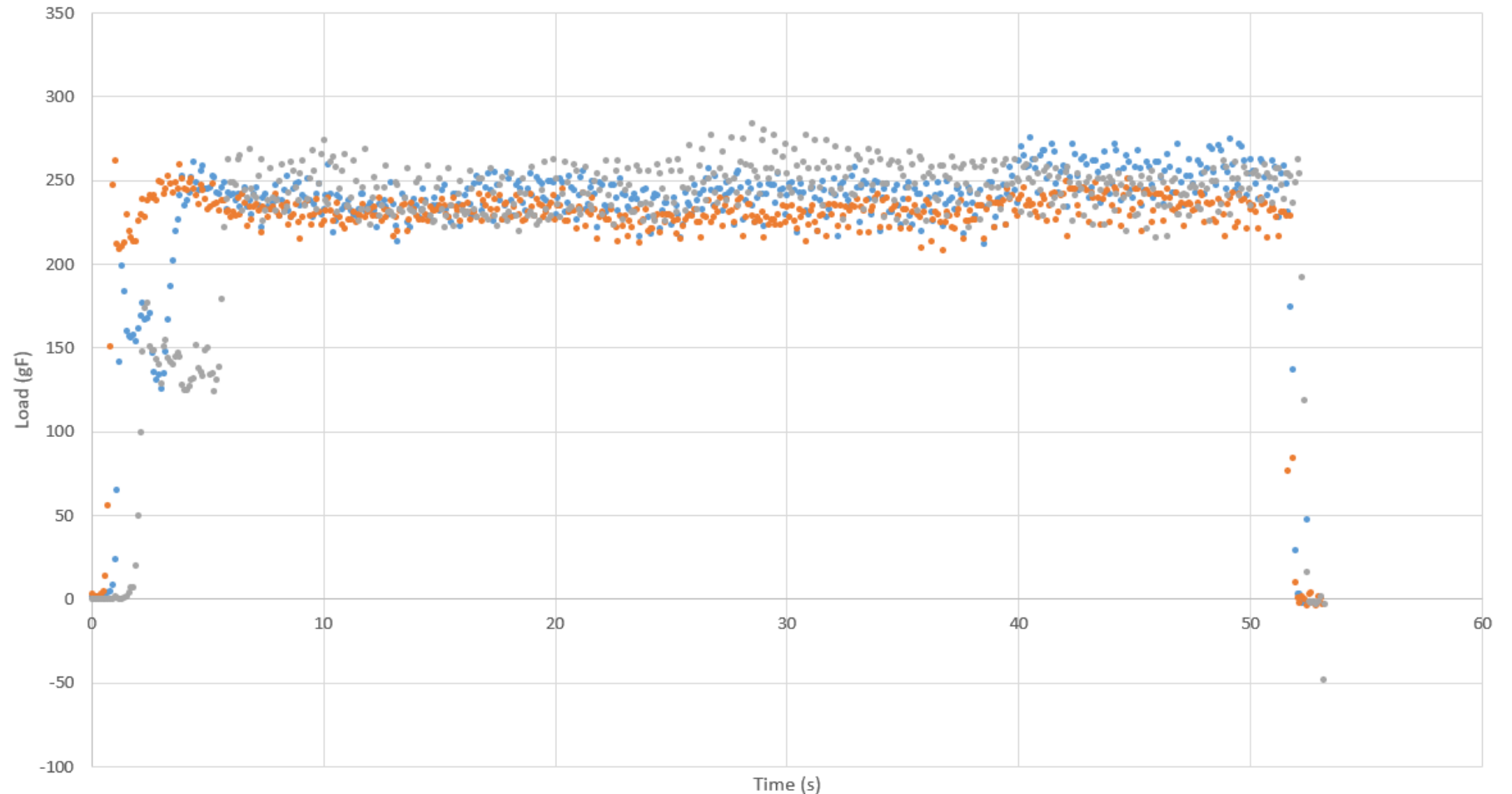
Constant Peel Rate of 299.9mm/min	
180-Degrees	
Test	Peel Adhesion (gF/25mm)
1	425.9931144
2	431.8852168
3	512.4252813
4	447.1764802
5	442.4069857
6	447.7886653
7	416.427305
8	450.5030271
Average	446.8257595



Dwell time: 24 hrs

Peel Force of Kapton Tape HB830 at 180-Degree Pull Test at 299.9mm/min with a dwell time of 24 Hours.

• Test 1 • Test 2 • Test 3

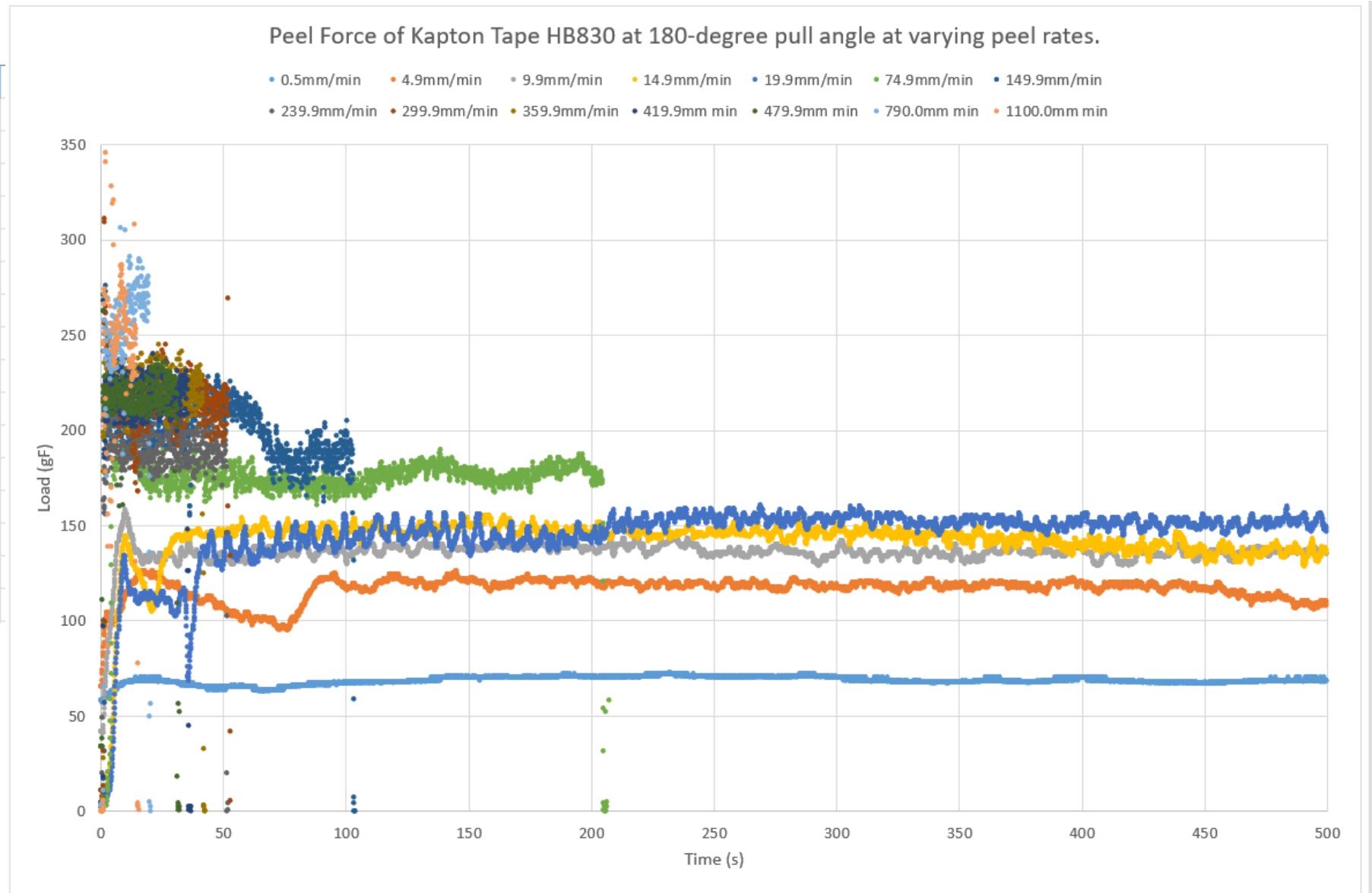


24 Hour Dwell Time

180-Degrees	
Test	Peel Strength (gF/25mm)
1	506.3174946
2	482.5341236
3	503.3182303
Average	497.3899495

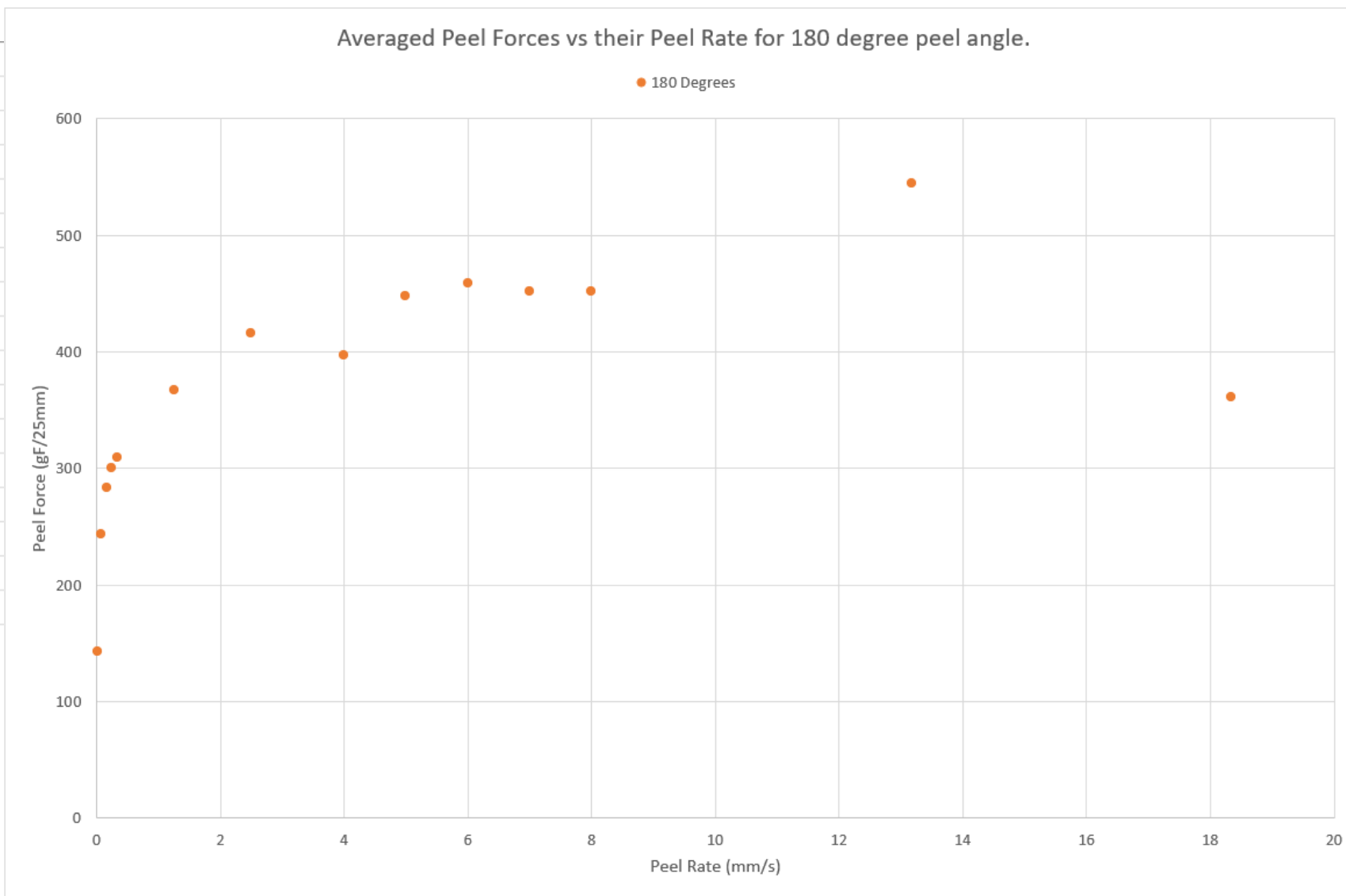
Dwell time: 1min, changing peel rate

Varying Peel Rates	
180-Degrees	
Peel Rate (mm/min)	Peel Force (gF/25mm)
0.5	143.1510943
4.9	243.5648148
9.9	283.7401971
14.9	300.5125975
19.9	309.8169672
74.9	367.141337
149.9	415.6495223
239.9	397.3644037
299.9	447.819356
359.9	458.8854736
419.9	452.4305556
479.9	452.0041191
790	544.2636986
1100	361.1691696



Dwell time: 1min, changing peel rate

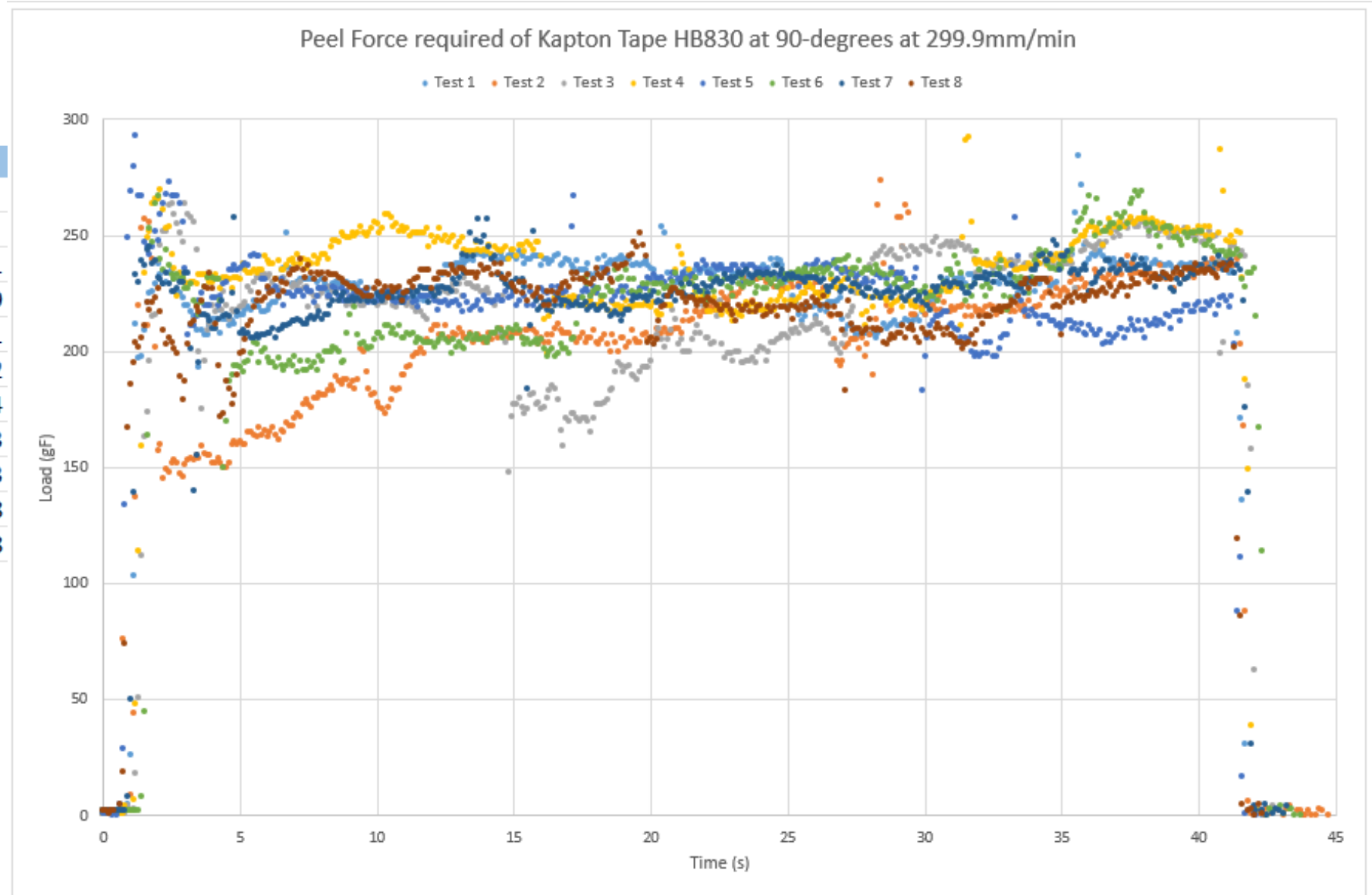
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239.9	397.3644037
299.9	447.819356
359.9	458.8854736
419.9	452.4305556
479.9	452.0041191
790	544.2636986
1100	361.1691696



90-Degree Peel Tests

Dwell time: 1 min

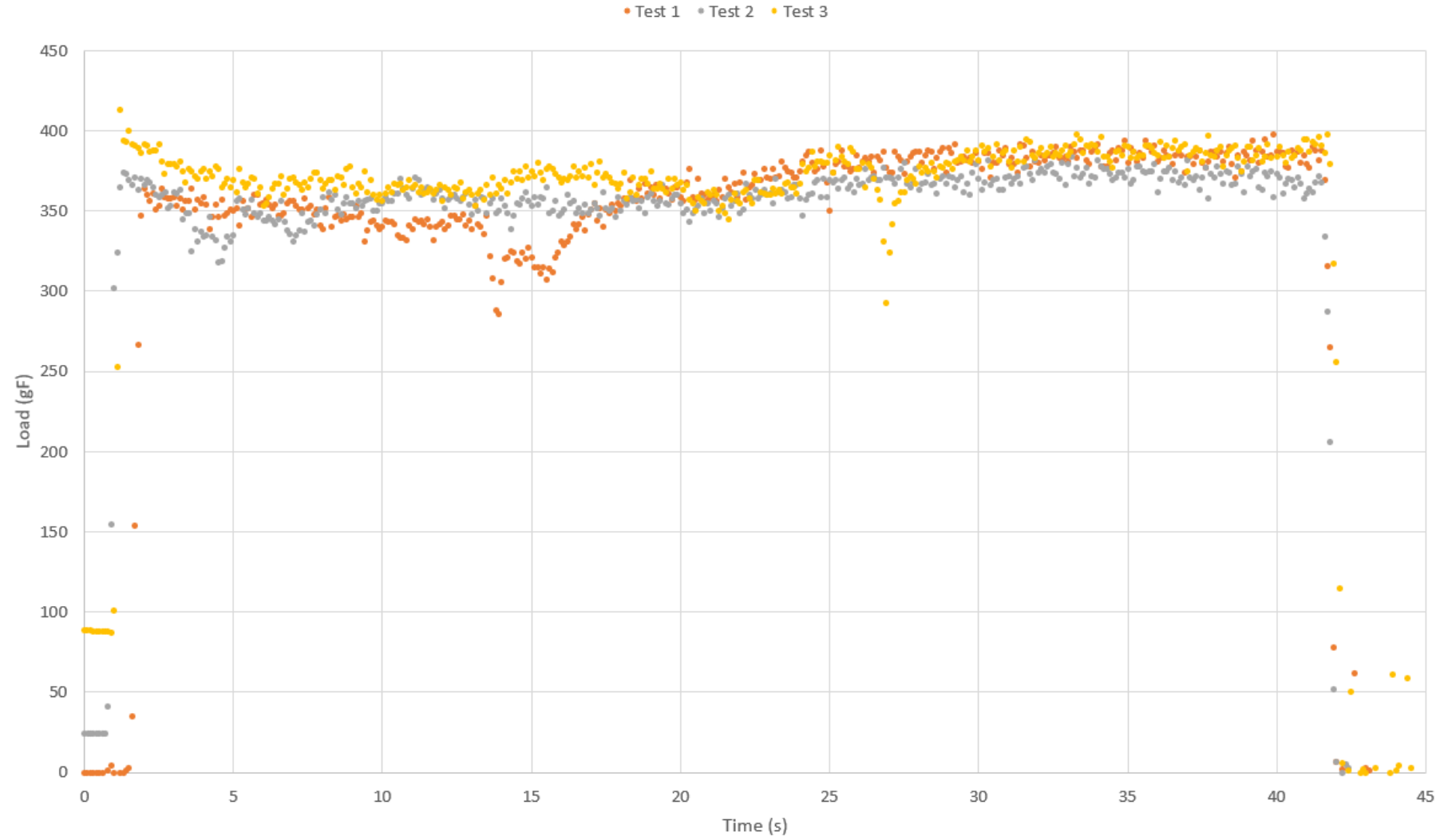
Constant Peel Rate of 299.9mm/min	
90-Degrees	
Test	Peel Force(gF/25mm)
1	481.3415751
2	441.609589
3	461.2318841
4	492.9758652
5	465.7311754
6	468.9016173
7	473.8558743
8	467.0798898
Average	469.0909338



Dwell time: 24 hrs

24 Hour Dwell Time	
90-Degrees	
Test	Peel Strength (gF/25mm)
1	760.0647139
2	754.1040528
3	776.2624547
Average	763.4770738

Peel Force of Kapton Tape HB830 at 90-Degree Pull Test at 299.9mm/min with a dwell time of 24 hours.

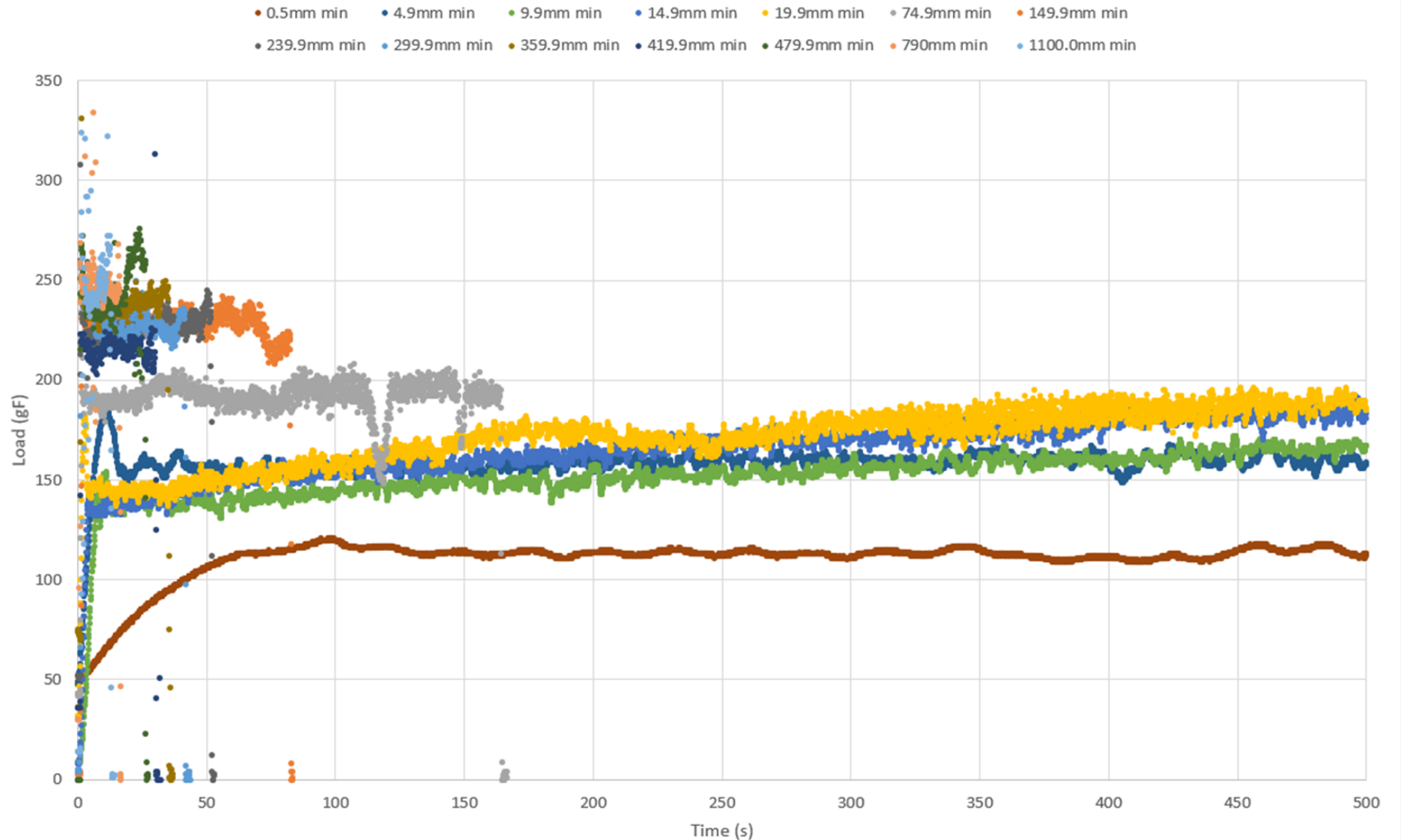


Dwell time: 1min, changing peel rate

Varying Peel Rates

Peel Rate(mm/min)	Peel Force (gF/25mm)
0.5	236.278592
4.9	330.5412416
9.9	319.4340343
14.9	346.3202862
19.9	357.9099327
74.9	399.9017913
149.9	476.0483871
239.9	473.8445753
299.9	474.5319635
359.9	495.549557
419.9	447.021419
479.9	509.2767296
790	515.3645833
1100	520.2380952

Peel Force of Kapton Tape HB830 at 90-degree pull angle at varying peel rates.



Dwell time: 1min, changing peel rate

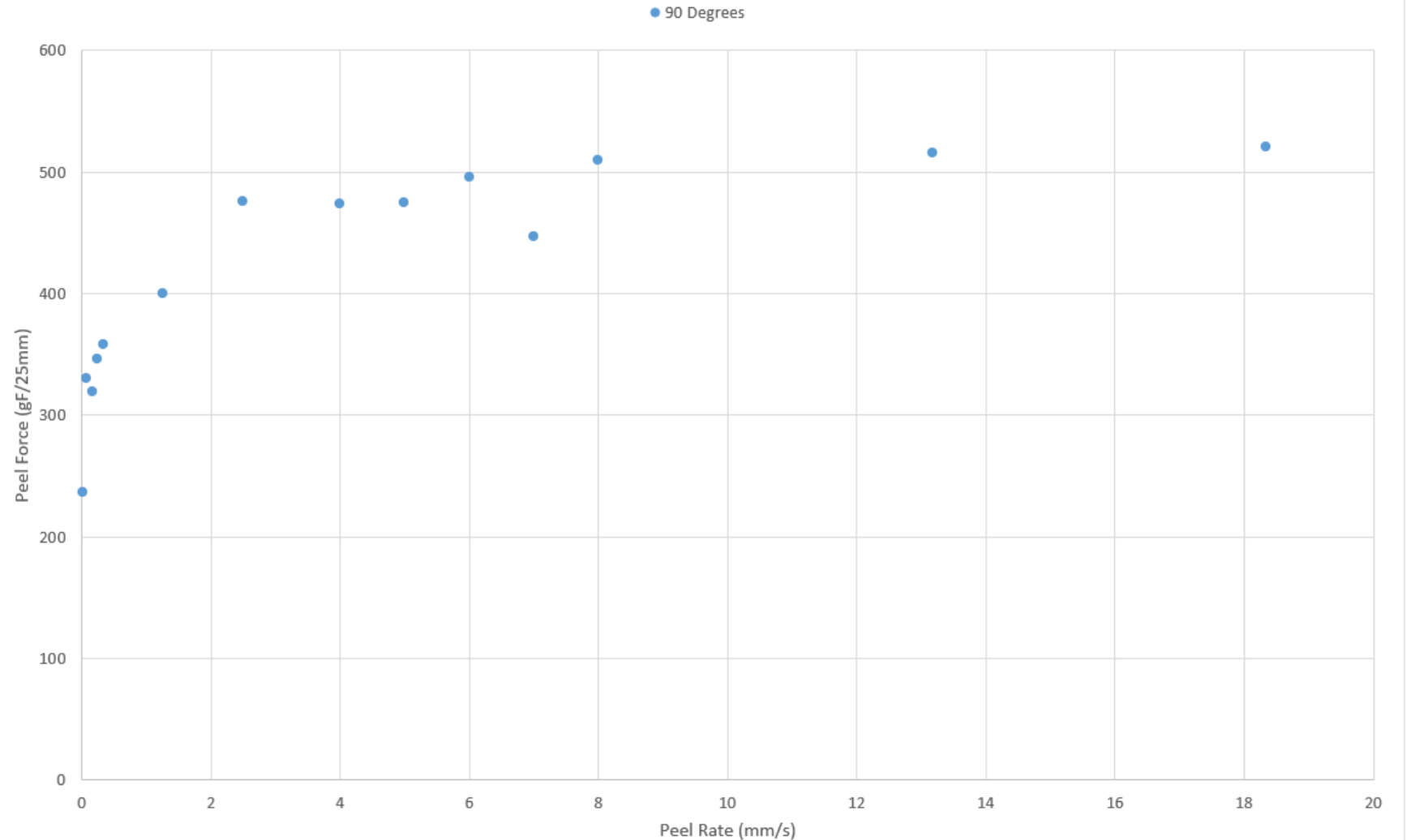
Varying Peel Rates

90-Degrees

Peel Rate(mm/s) Peel Force (gF/25mm)

0.5	236.278592
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419.9	447.021419
479.9	509.2767296
790	515.3645833
1100	520.2380952

Averaged Peel Forces vs their Peel Rate for 90 degree peel angle.



Conclusion

- Results presented for peel Adhesion test of Kapton Tape HB830
- Tests are reproducible.
- Currently, cannot reproduce the target value quoted in the datasheet. Manufacturer has been contacted.
- Also working on comparison between data at 90deg and 180deg.