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Data Interpretation 5: Coatings

N. Randall

DLC-on-Steel (coated diesel injectors)

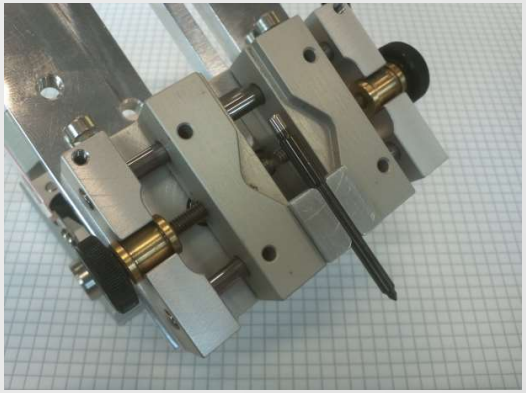
Coating: Diamond-like Carbon (DLC)

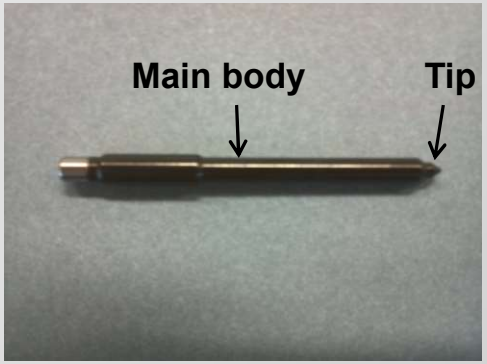
Thickness: 2 µm

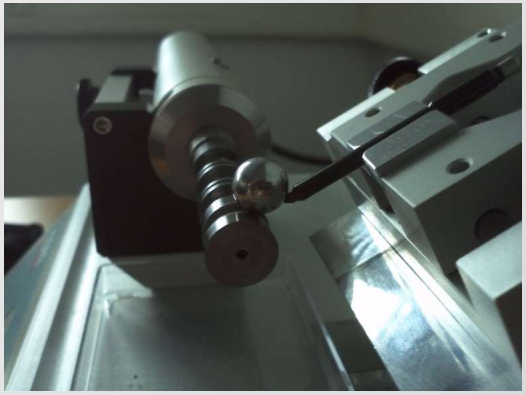
Substrate: steel

Application: industrial cutting tools

DLC-on-Steel (coated diesel injectors)







Ball diameter: 10 mm
Slurry: 0.2 µm Superfine

<u>Typical abrasion times:</u>
Main body: 30s with 60º angle
Tip: 20s with 60º angle

DLC-on-Steel (coated diesel injectors)

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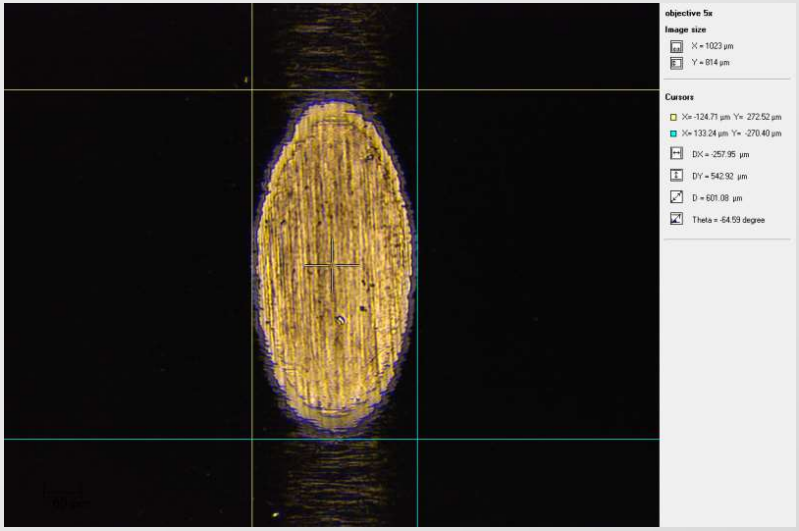
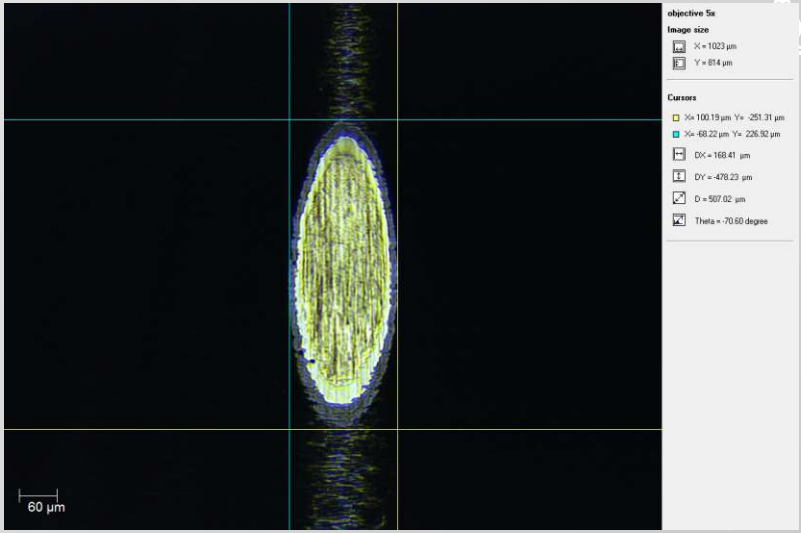
MAIN BODY



TIP

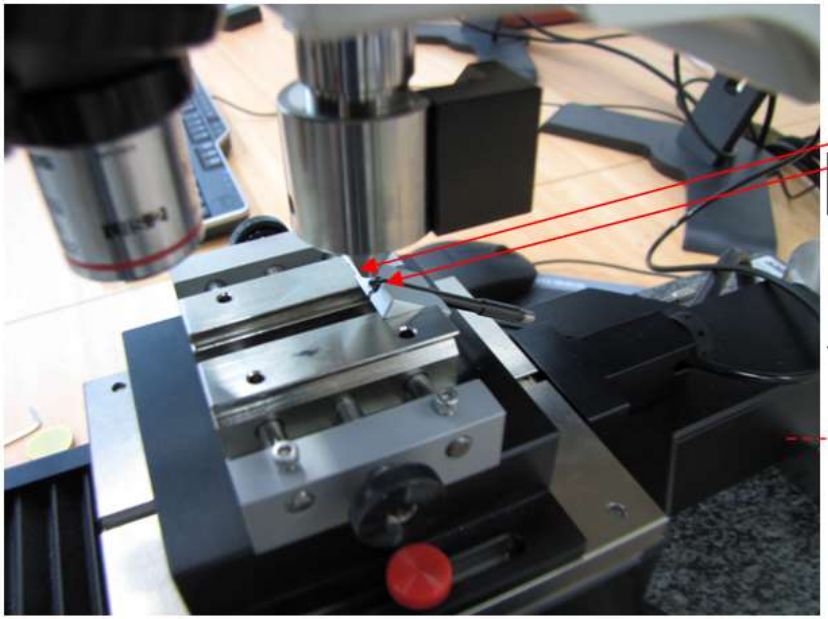


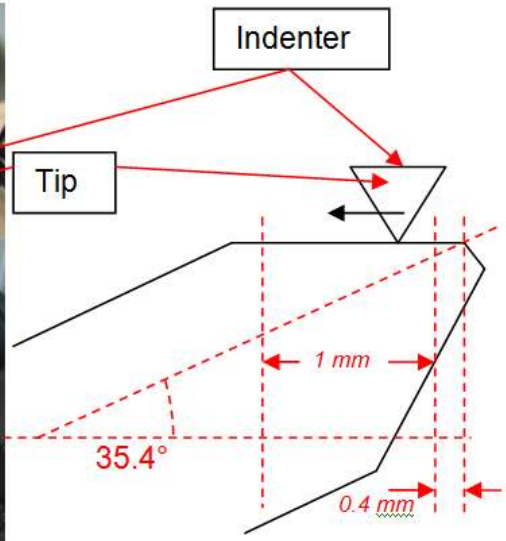
Cap No	Small radius	Intermediate	Large radius	Outer Layer	Inner Layer	Total Layer
1	232.8	255.5	272.6	0.90	1.11	2.01
2	202.0	230.2	253.2	1.11	1.22	2.33
3	207.9	234.0	247.8	0.67	1.15	1.82
4	258.2	281.5	298.5	0.98	1.26	2.24
5	127.1	167.3	201.5	1.26	1.19	2.44
				0.98	1.19	2.17
				0.22	0.06	0.25

Cap No	Small radius	Intermediate	Large radius	Outer Layer	Inner Layer	Total Layer
Tip test	39.0	108.0	155.0	1.24	1.01	2.25
1	167.5	191.0	223.0	1.32	0.84	2.17
2	135.5	166.5	193.0	0.95	0.94	1.89
3	146.0	180.0	205.5	0.98	1.11	2.09
4	166.5	200.5	221.5	0.89	1.25	2.13
5	168.0	202.0	226.0	1.03	1.26	2.29
6	181.5	208.5	235.0	1.18	1.05	2.23
				1.08	1.07	2.15
				0.16	0.15	0.13

DLC-on-Steel (coated diesel injectors)

Two critical locations





The measurement was done at 0.4 to 1.4 mm distance from the extremity of the tip.

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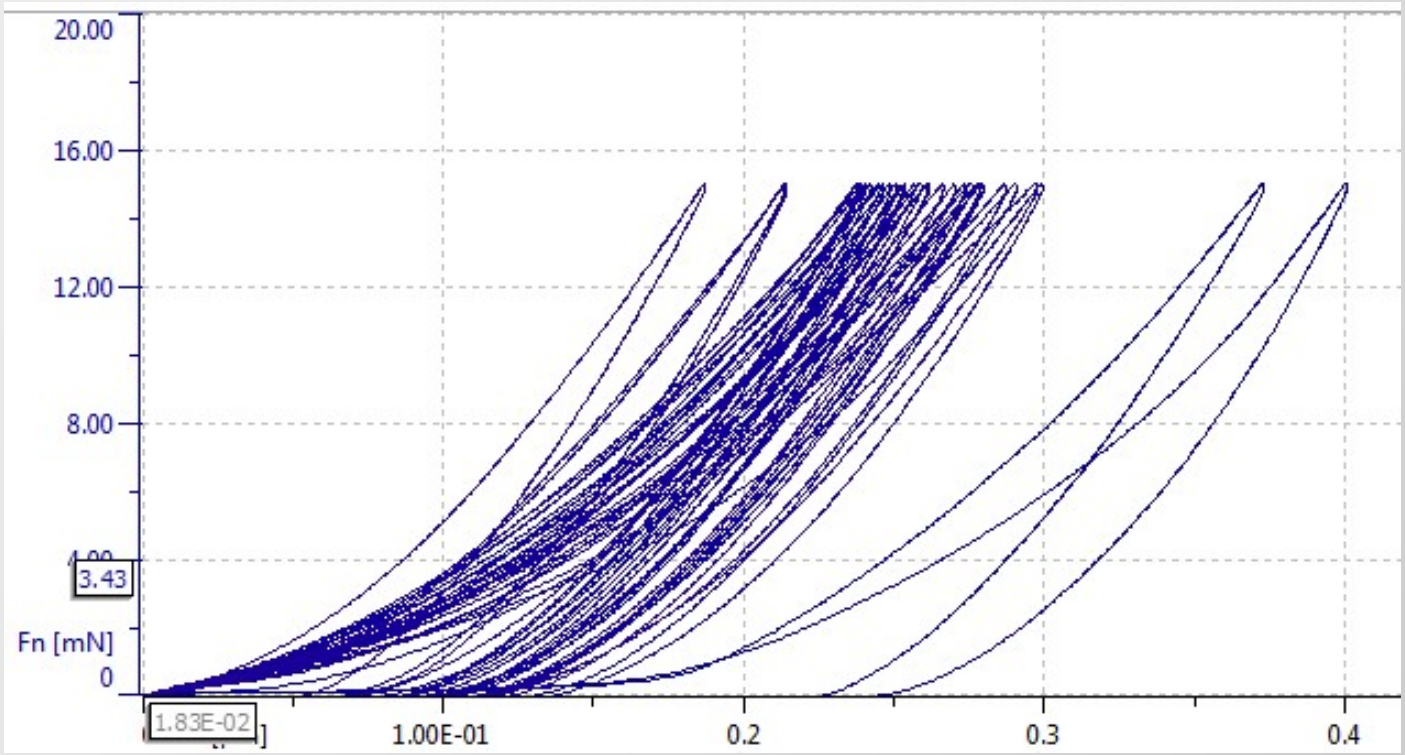

Expect significant statistical variation on rough industrial coatings !

DLC-on-Steel (coated piston rings)

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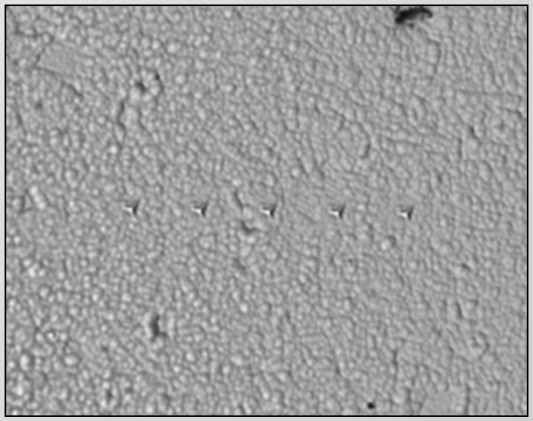
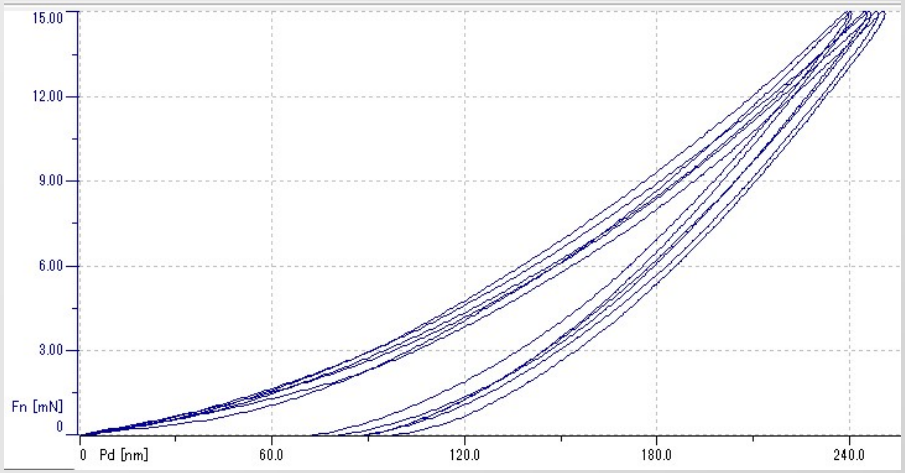
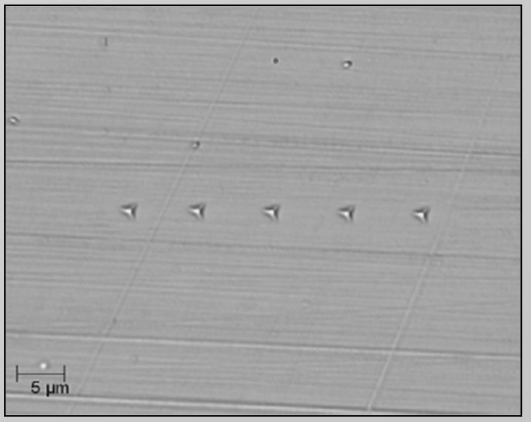






Al-on-Si

Coating: Aluminium

Thickness: ~ 1 µm

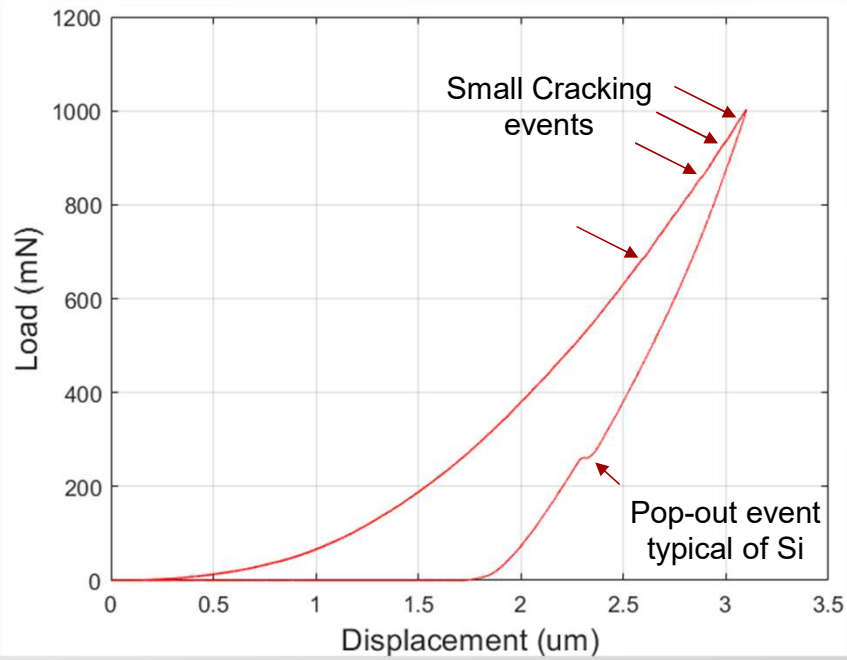
Substrate: Si wafer

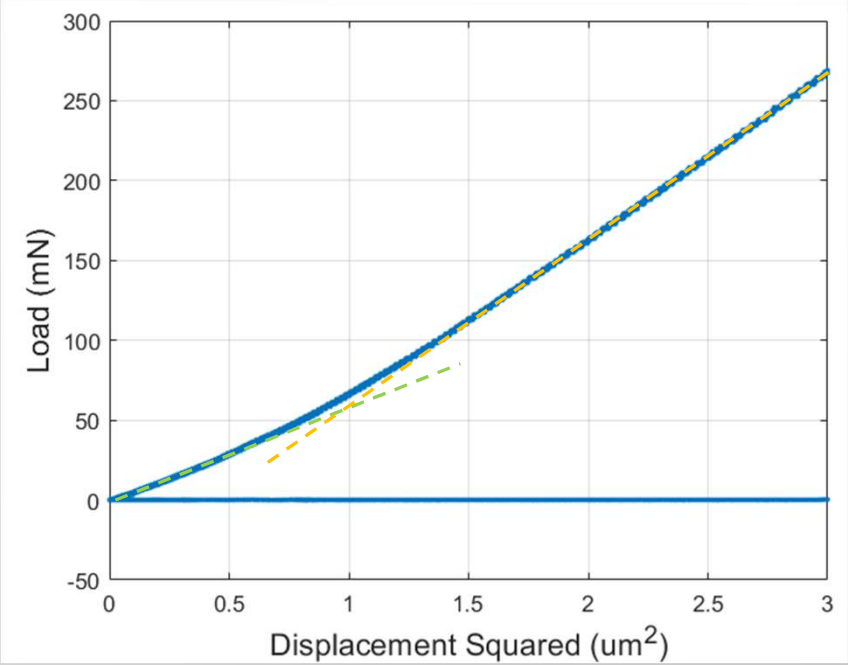
Application: microelectronics

Al-on-Si

Observations on load-depth curve (cracks, pop-out)

P vs d^2 analysis shows us the approximate coating thickness

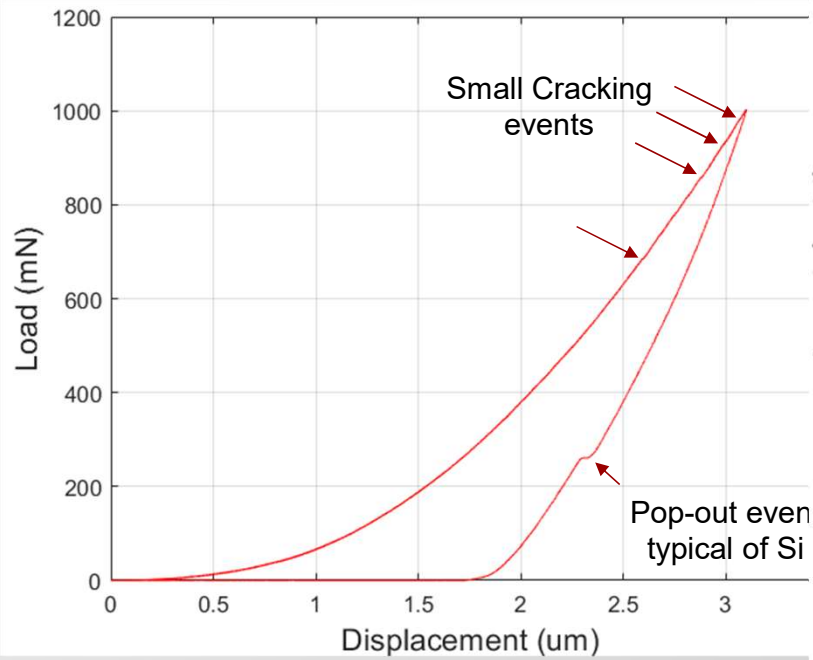


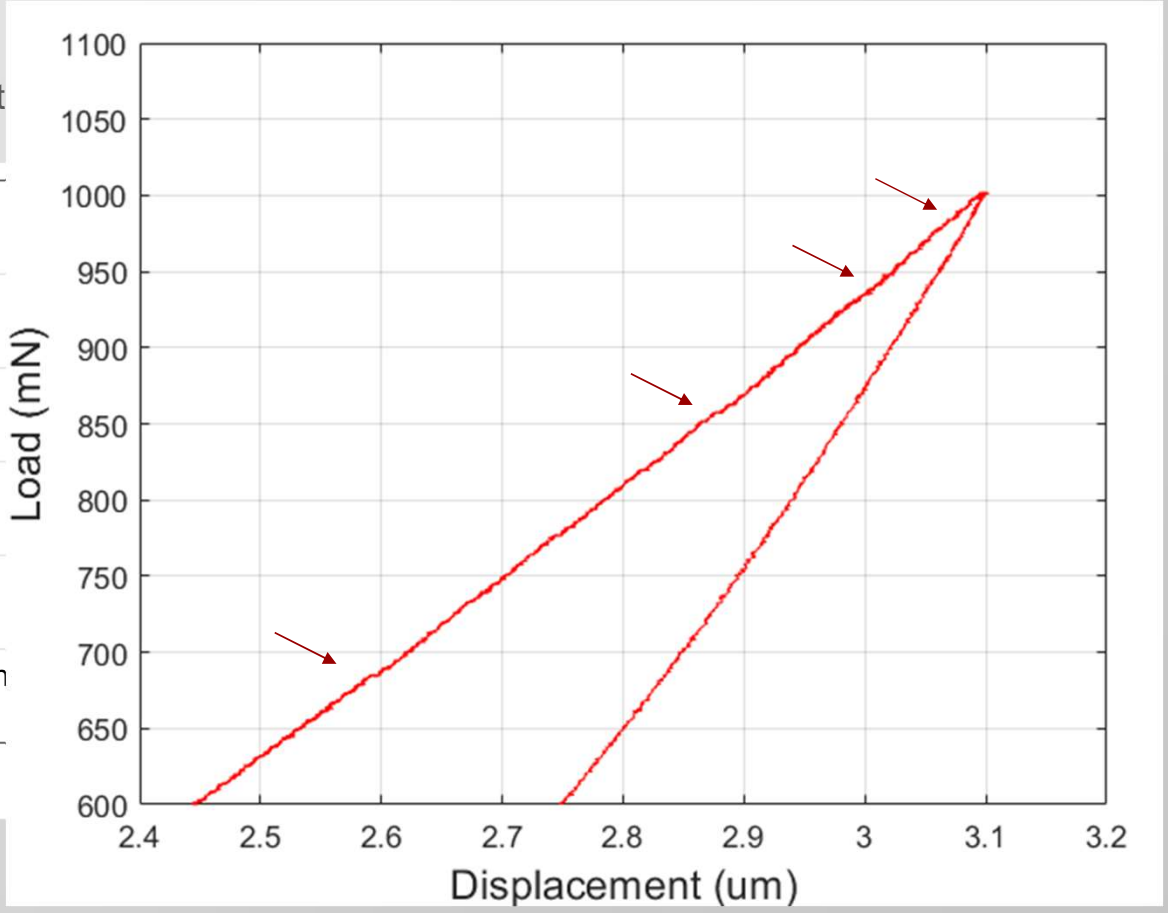


Al-on-Si

Observations on load-depth curve (cracks, pop-out)

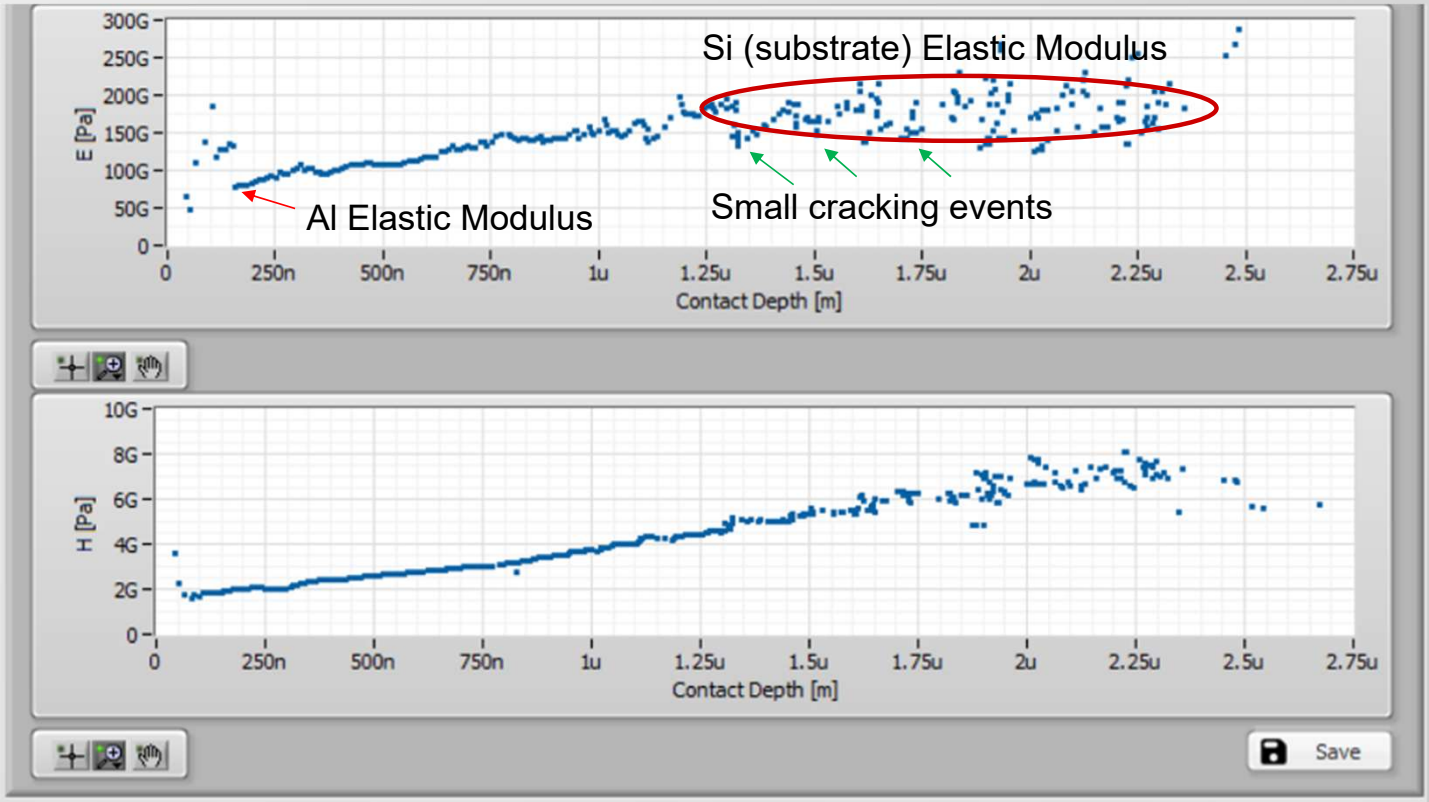
P vs d^2 analysis shows us the approximate coating t





Al-on-Si

Depth profiles:



Al-on-Si common in semiconductor applications

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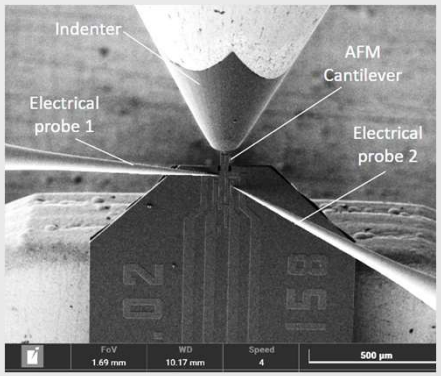
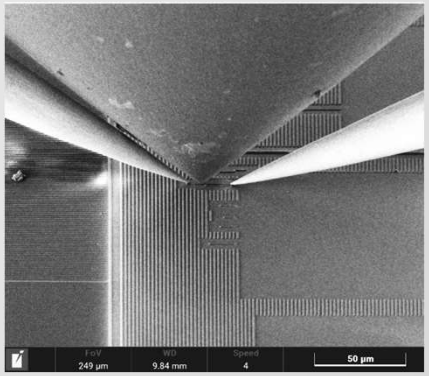
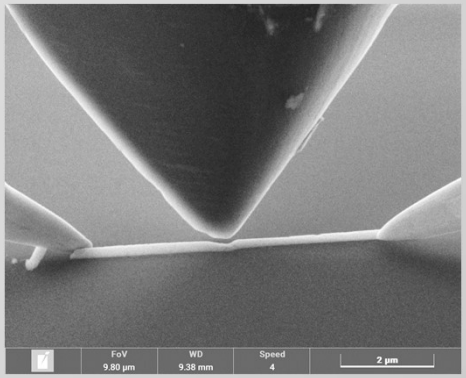
Gauge Factor of MEMS



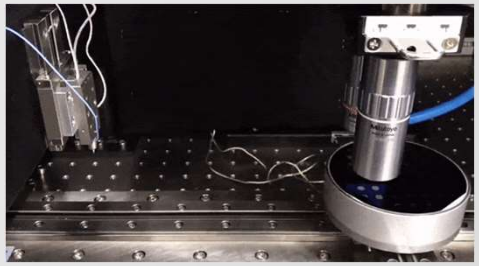
Mechanical testing on chips



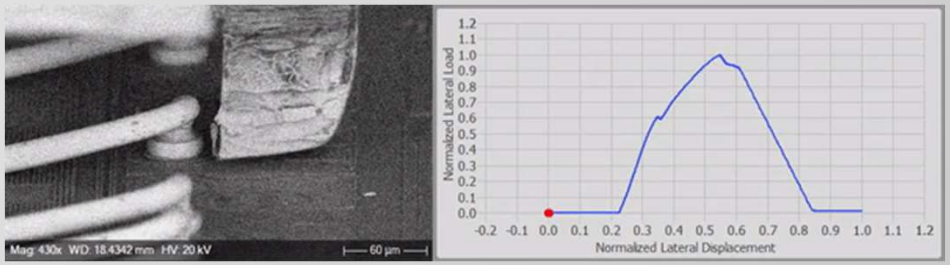
Testing on Piezoelectric wire



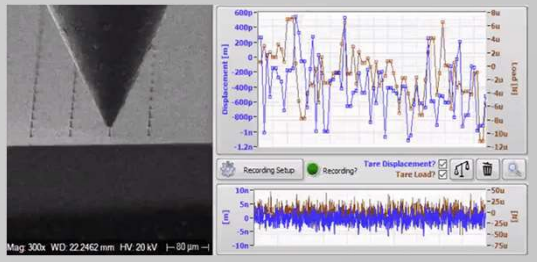
Whole-wafer mapping



Shear test on wire bonding



Automated Si Pillar Compression



(Courtesy of ST Microelectronics)