

SEVENTEENTH ANNUAL

BiTS

Burn-in & Test Strategies Workshop

TM

March 6 - 9, 2016

**Hilton Phoenix / Mesa Hotel
Mesa, Arizona**

Archive- Session 7

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Session 7

Mike Ramsey
Session Chair

BiTS Workshop 2016 Schedule

Solutions Day

Wednesday March 9 - 8:00 am

Very Touching

"Implementation of MEMS Particles Dramatically Improves
Conventional Rubber Sockets"

Dave OH, Justin Yun, Kanghee Kim - TSE Co., Ltd.

"Contacting DC - 40GHz and beyond"

Tony Tiengtum - Xcerra Corporation

"Small Form Factor Sockets and Circuits for Silicon and Platform
Validation"

James Rathburn - HSIO Technologies, LLC

"Prediction of Contact Mark for QFN package"

Yuanjun Shi - Twin Solution

Implementation of MEMS Particles Dramatically Improves Conventional Rubber Sockets

**Justin Yun,
Dave Oh, & Kang Hee Kim
TSE Co., Ltd.**



**2016 BiTS Workshop
March 6 - 9, 2016**

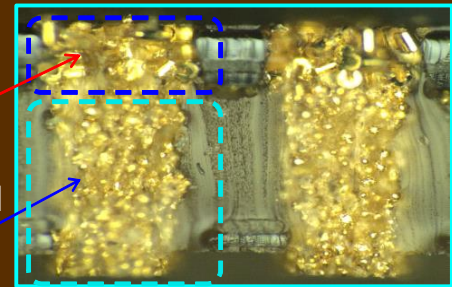
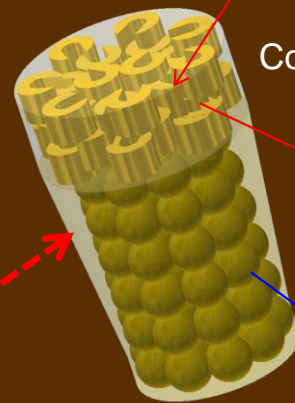
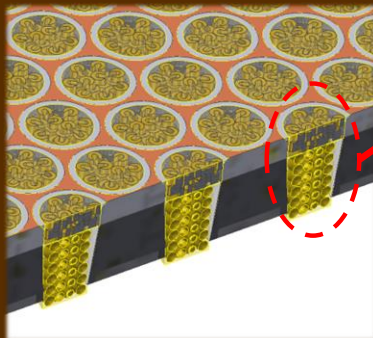
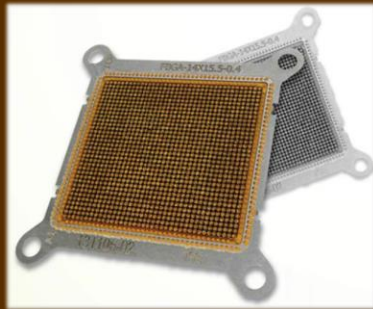


Overview

- **MRC Socket Background**
- **Investigation**
- **Lab & Production Test Results Review**
- **Analysis**
- **Summary & Conclusion**

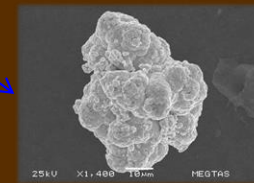
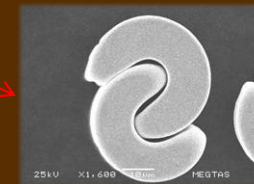
MRC Socket Background

- MRC Socket
 - ✓ MEMS Particle + Conductive Powder



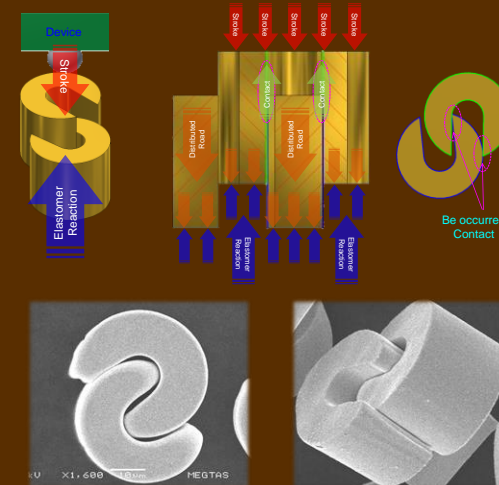
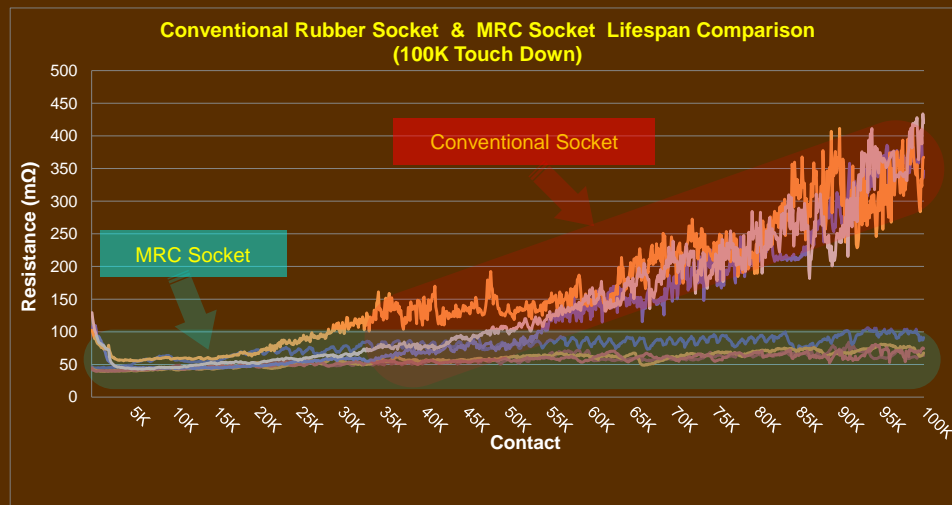
MEMS Particle

Conventional Powder



MRC Socket Background

- MRC vs Conventional Rubber Socket Lifespan
 - ✓ MRC : Consistent Cres Over Touchdown Lifetime

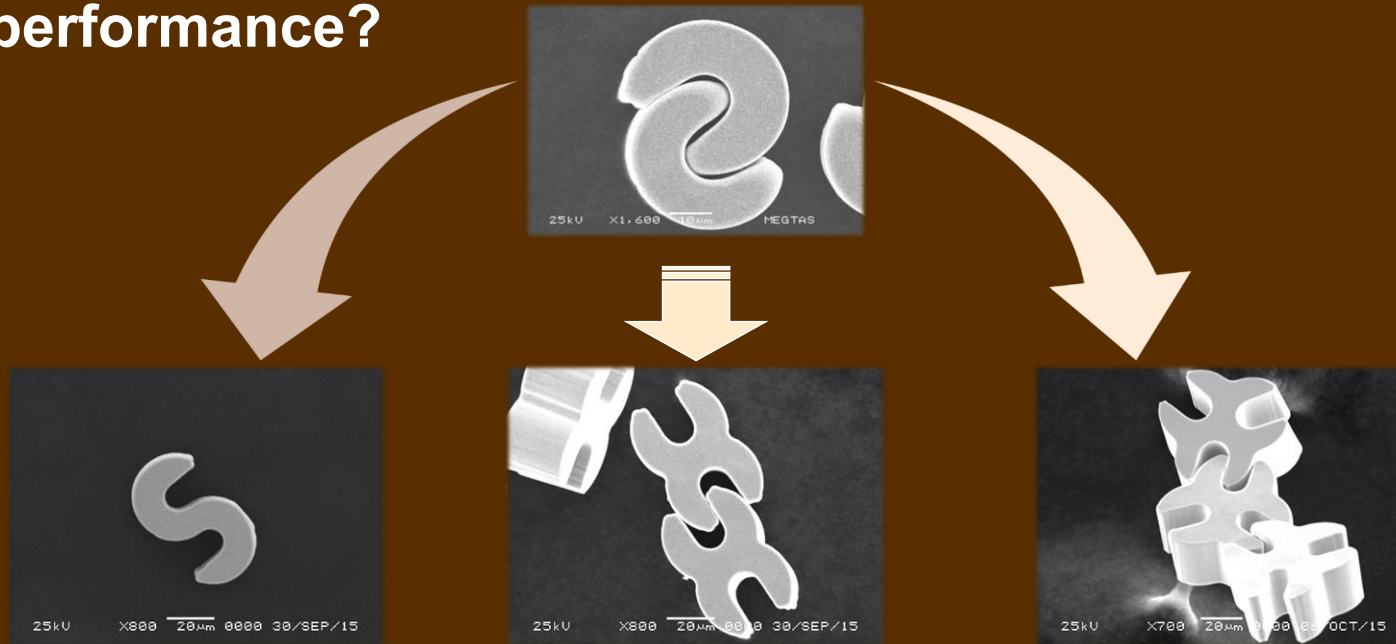


Docking!!

- Why is MRC performance better than conventional rubber socket?
 - ✓ Contact reliability is improved by electromechanical docking of MEMS particles.

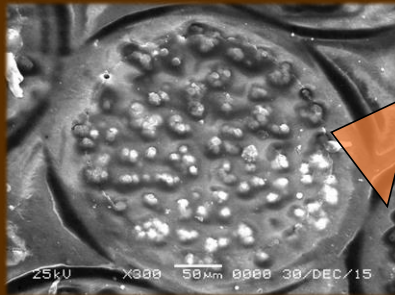
Investigation

- How to improve the MEMS particle docking performance?

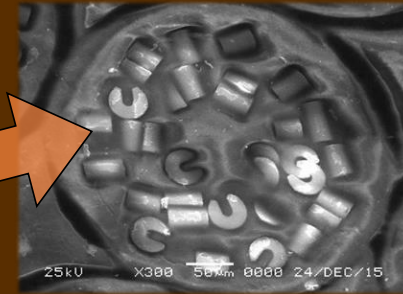
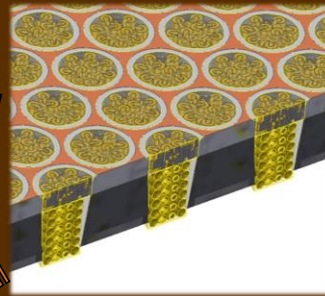


- ✓ Alternative particle shapes increase contact area and improved docking
- ✓ Improvements in electrical performance (Resistance, C.C.C, Lifespan)

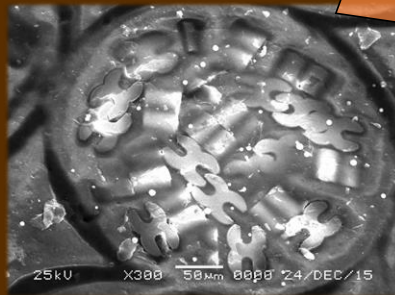
Test Sample



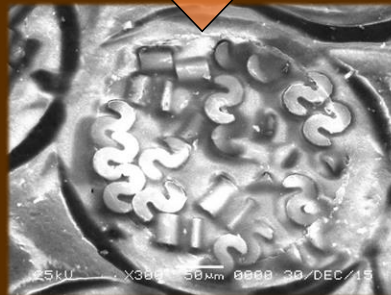
Conventional



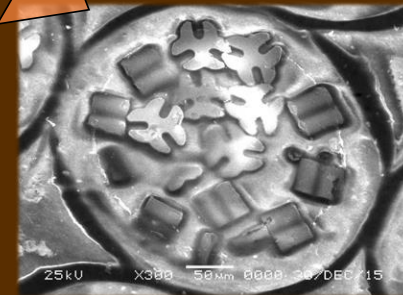
U



Chain



S

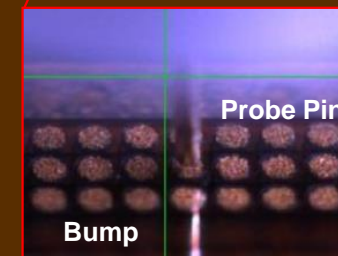
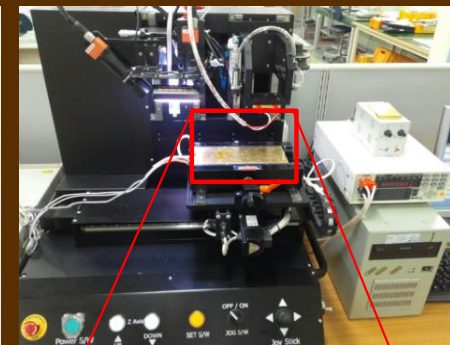


Y

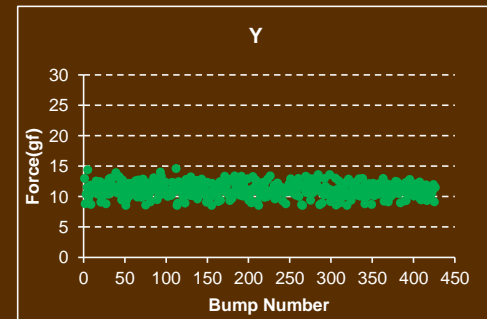
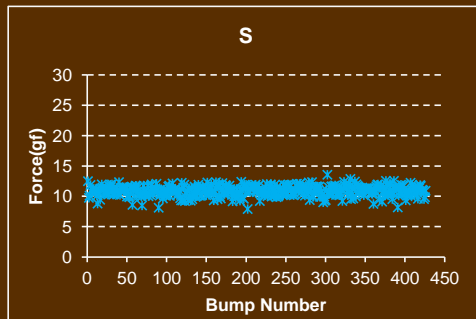
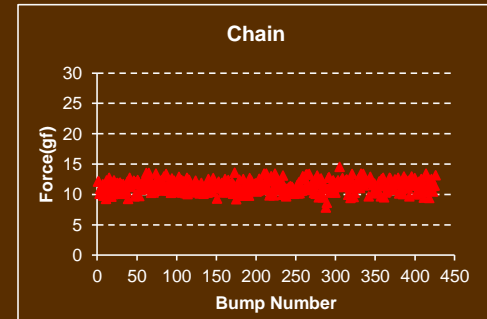
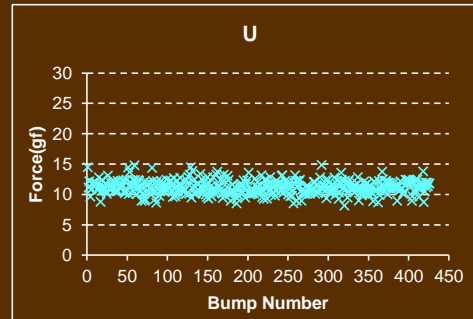
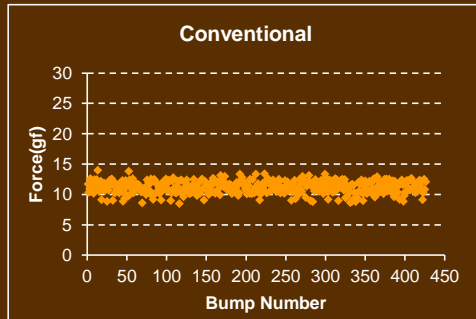
Docking Particle Evaluation

Force / Resistance / Lifespan / C.C.C Evaluation Condition

- ✓ Tester : TSE IT-490
- ✓ Temp : 23°C
- ✓ Probe Size : $\varnothing 0.23\text{mm}$
- ✓ Probe Material : BeCu + Plating Au
- ✓ Socket Device : 450FBGA
- ✓ Socket : 0.35mm Pitch
- ✓ Socket Bump Size : $\Phi 0.26\text{mm}$
- ✓ Socket Bump Count : 450ea
- ✓ Particle Shape : Ni-Silver / Chain / U / S / Y
- ✓ Lifespan Stroke : 120um
- ✓ Lifespan : Touch Down 300K
- ✓ C.C.C Contact stroke : stroke @Force 40g
- ✓ DC Power Supply 3306D (Topward MAX 6A)

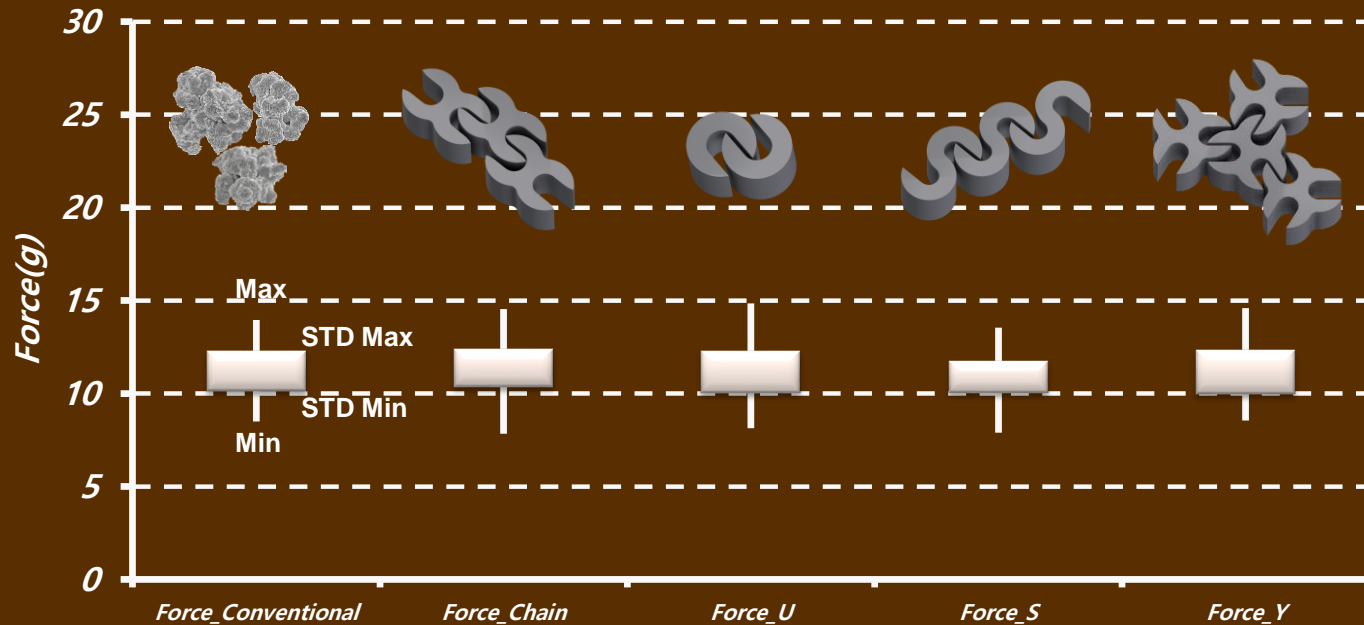


Evaluation – Force



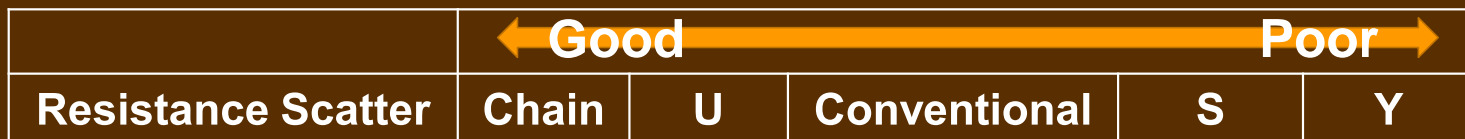
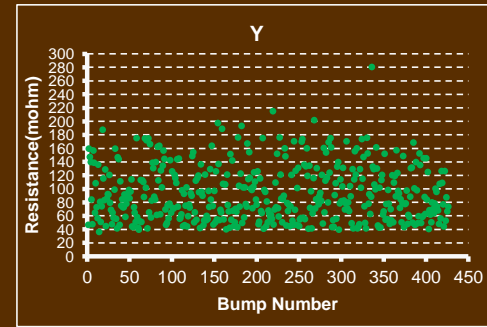
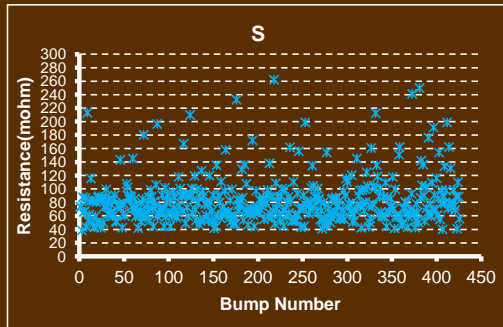
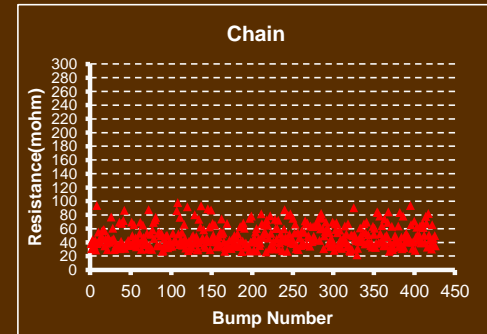
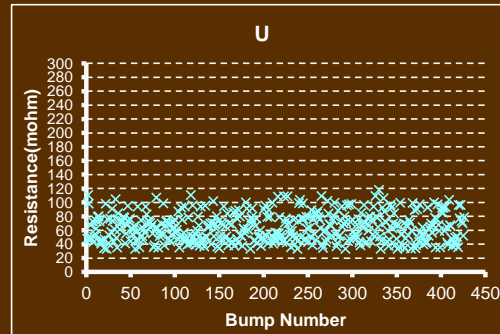
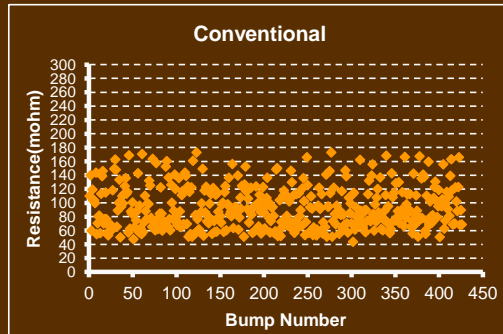
Force Scatter	Chain	Conventional	U	S	Y

Evaluation – Force

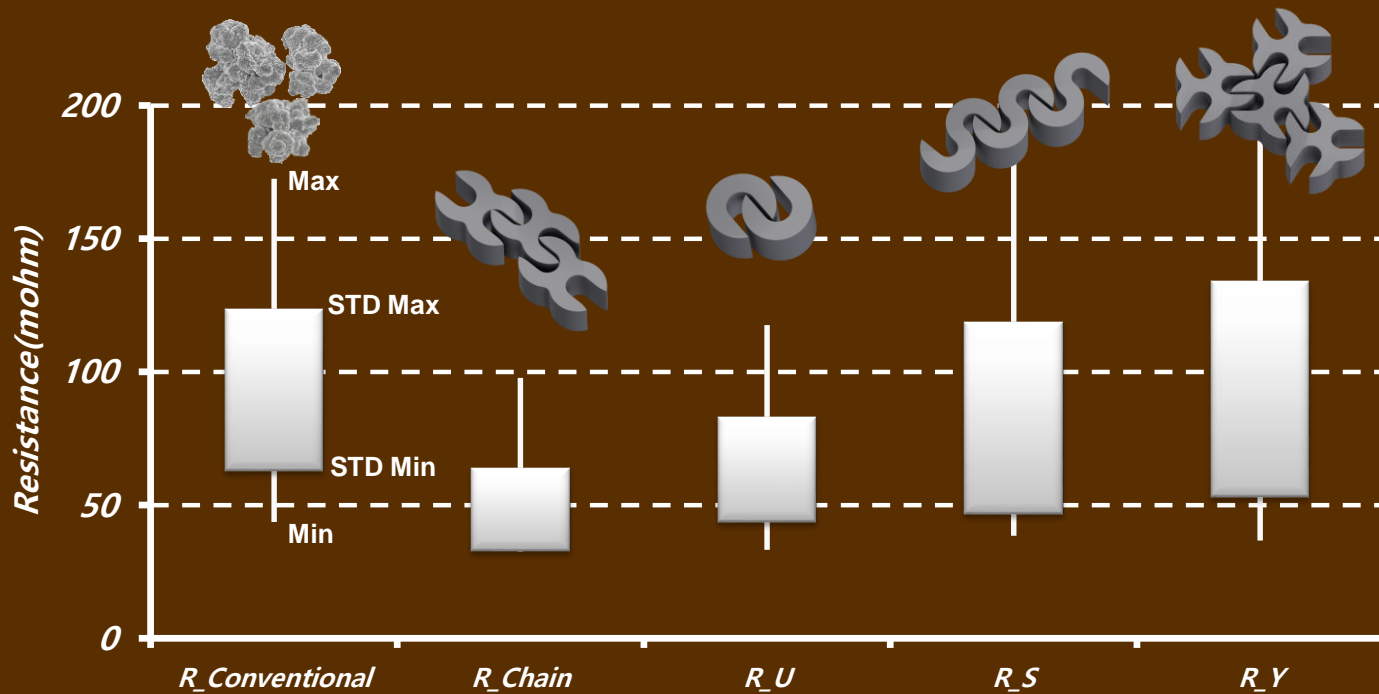


Force Scatter	Chain	Conventional	U	S	Y

Evaluation – Resistance

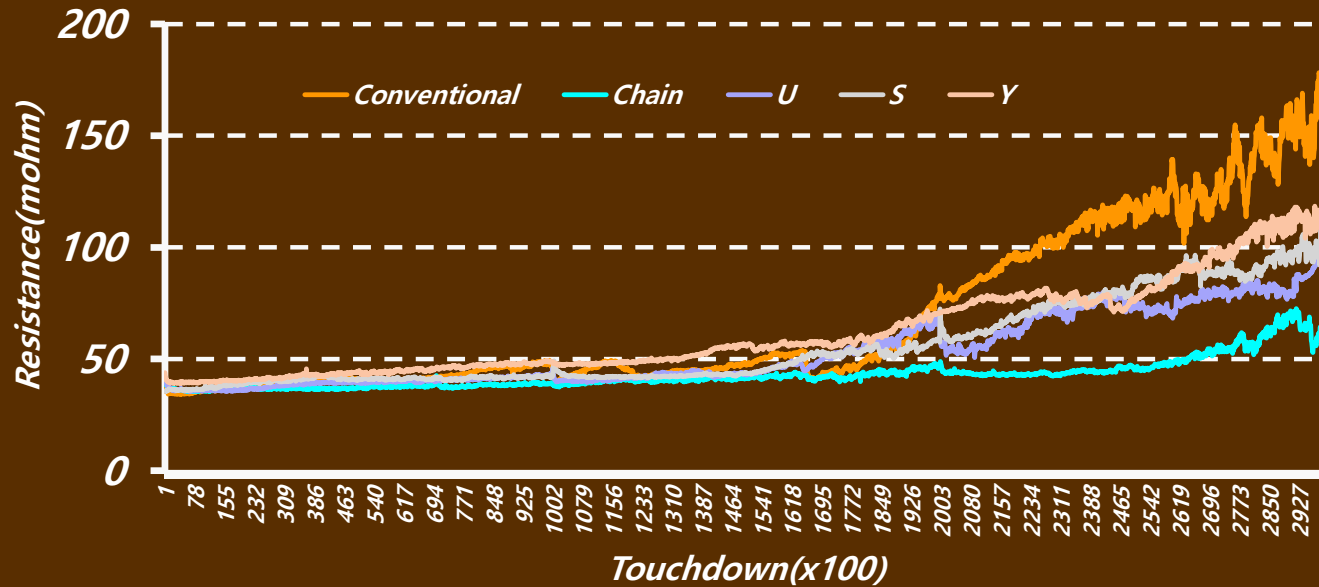


Evaluation – Short Term Resistance



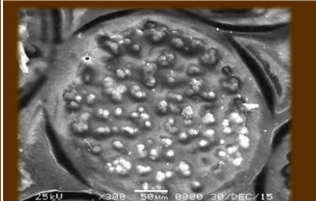
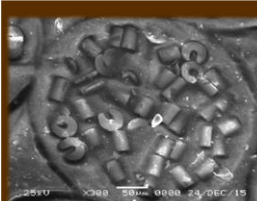
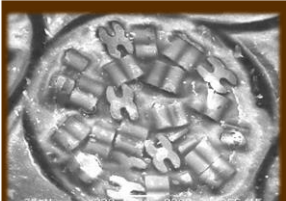
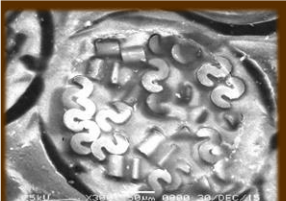
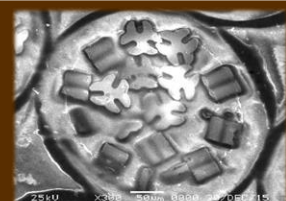
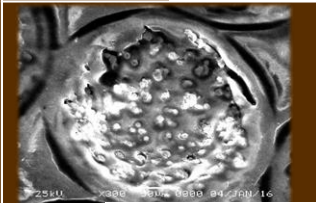
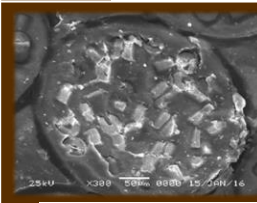
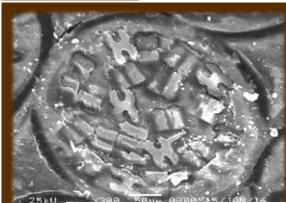
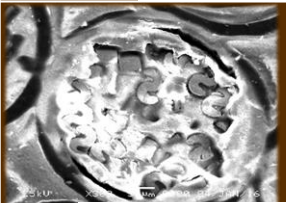
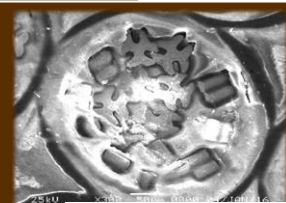
	← Good → Poor →				
Resistance Scatter	Chain	U	Conventional	S	Y

Evaluation - Lifespan

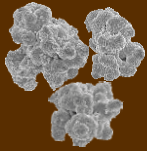






	← Good → Poor				
Increases Resistance	Chain	U	S	Y	Conventional

Evaluation - Deflection

Conventional	U	Chain	S	Y
 Initial	 Initial	 Initial	 Initial	 Initial
 T/D 300k	 T/D 300k	 T/D 300k	 T/D 300k	 T/D 300k
Deflection 41.8um	Deflection 24.8um	Deflection 21.1um	Deflection 38.7um	Deflection 34.4um

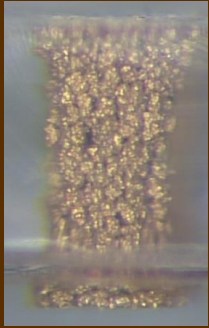

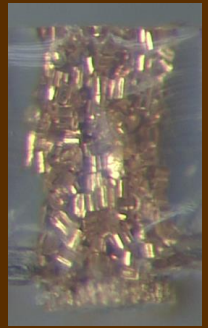
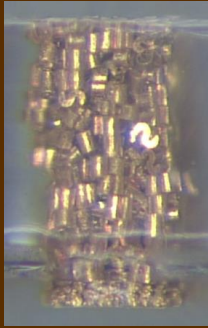
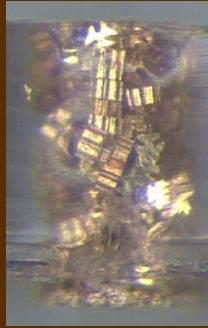
Evaluation – C.C.C

	Conventional	U	Chain	S	Y
					
Min.	1.5A	2.4A	2.7A	2.1A	2.1A
Max.	2.2A	3.6A	3.9A	3.5A	3.6A
Average	1.86A	3.13A	3.37A	2.83A	2.85A



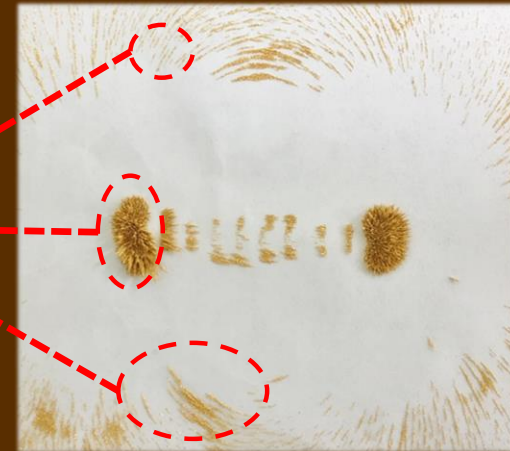
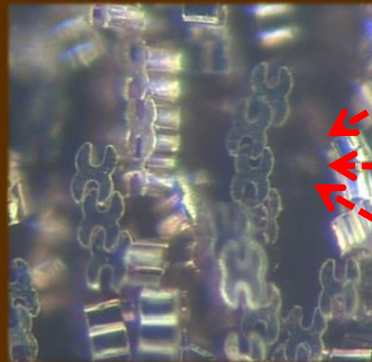
Analysis

▪ Bump Section

	Conventional	Chain	U	S	Y
					
Gathering	◎	○	△	X	XX
Docking		○	△	X	△
		Align in the same direction		Random Alignment	Random Alignment

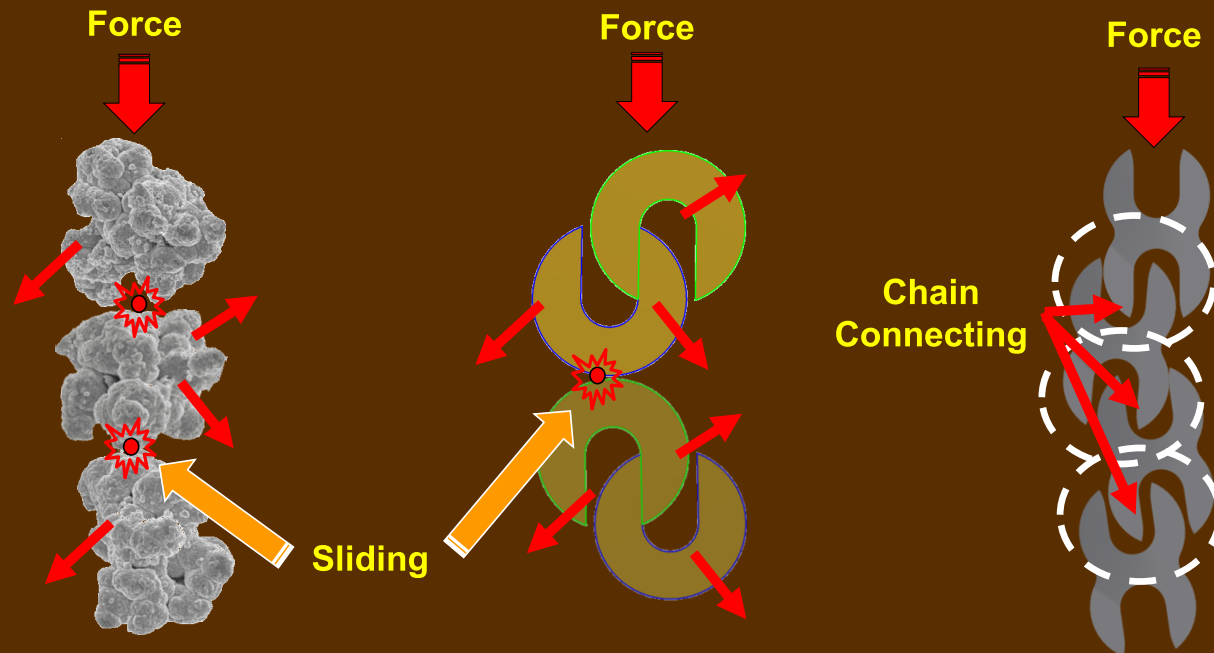
Analysis

- Why does the chain type particle perform differently?
 - ✓ Magnet field direction \Leftrightarrow Aligns with the docking shape of the particles



Analysis

- Particle Docking Chains are created by magnetized MEMS particles
- ✓ Protects mechanical integrity of the docking structure from external forces.
- ✓ Consistent electrical contact through changes in environmental conditions.



Summary

- **Force**
 - ✓ Conventional / U / Chain / S / Y ⇒ No deviation
- **Short Term Resistance**
 - ✓ Conventional , Chain Particle “Good”
- **Lifespan (Resistance Increase by Touchdown)**
 - ✓ Chain Particle “Good”, Conventional “Poor”

Summary

- **Deflection**

- ✓ Chain Particle “Good”, Conventional “Poor”

- **C.C.C**

- ✓ Chain Particle “Good”,
Conventional & S Particle “Poor”

Conclusion

▪ Particle Shape

- ✓ If the particle shape is aligned with the direction of the magnetic force, the docking performance is enhanced.

▪ Chain Type Particle

- ✓ Extended particle conductivity to magnetic management
- ✓ Creates robust electromechanical docking chain
- ✓ Docking chains improve contact bump performance
 - Docking durability improves
 - Contact point stability improves
 - Deflection decreases

Further Study

- MEMS particle size optimization
- Improve MEMS particle productivity
- Improve MRC's power & signal integrity