ATOTECH

New Improved Direct Metallization Process

NeoLink® E

Joe Arnold – SUR/FIN 2017

Technology for tomorrow's solutions

Contents

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Direct Metallization: NeoLink® E

Principle

NeoLink® E – Direct Metallization

New Generation of Copper Link for Direct Metallization

- New design of copper link (CuLink)
- Higher deposit conductivity before Acid Copper Plating
- Improved efficiency and lower contend of Pd in the working Activator Bath
- Highly Stable process – without the use of chemical stabilizers
- Cost efficient process – high productivity
- Easy to use
- Suitable for ABS & ABS+PC
- Suitable for small & large parts

NeoLink® E – Direct Metallization

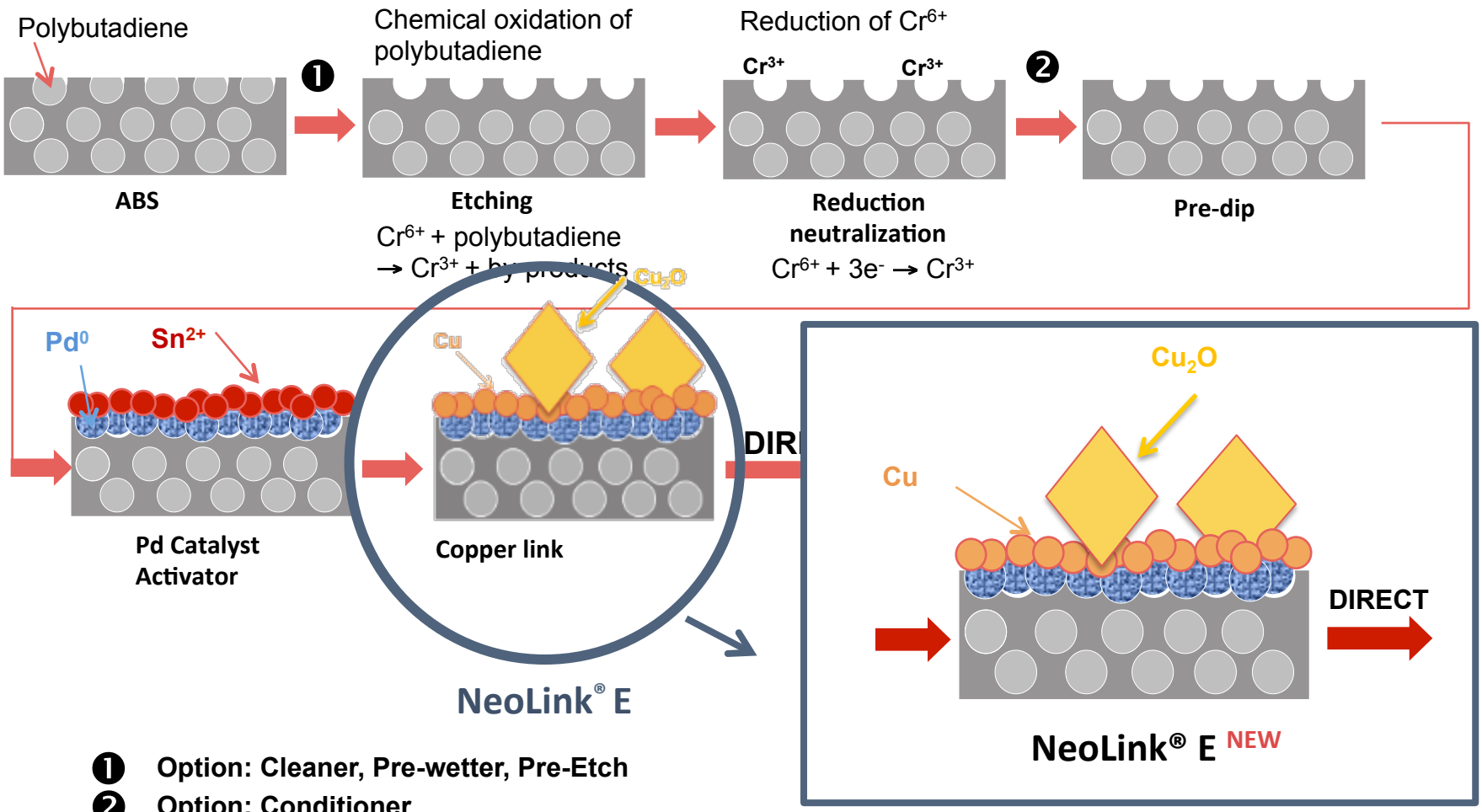
Process Sequence

NeoLink® E	Function
Cleaner (Optional)	UniClean® 151 or Alkalume 141 Cleaning step to remove fingerprints or other dirt
CrO_3-H_2SO_4 Etch	NeoLink® Additive CR Changing the ABS surface morphology & polarity
Reducer	NeoLink® Reducer CR Reducing left over CrVI on the surface to CrIII
Pre-dip	Conditioning of liquid film on parts to lower impact on Catalyst
Coll. Pd - Catalyst	NeoLink® Activator E Activating of surface with colloidal Pd particles
Copper Link	NeoLink® E Cross linking Pd particles and creating conductivity

New!

Standard Process Sequence for ABS

Direct Metallization – NeoLink® E



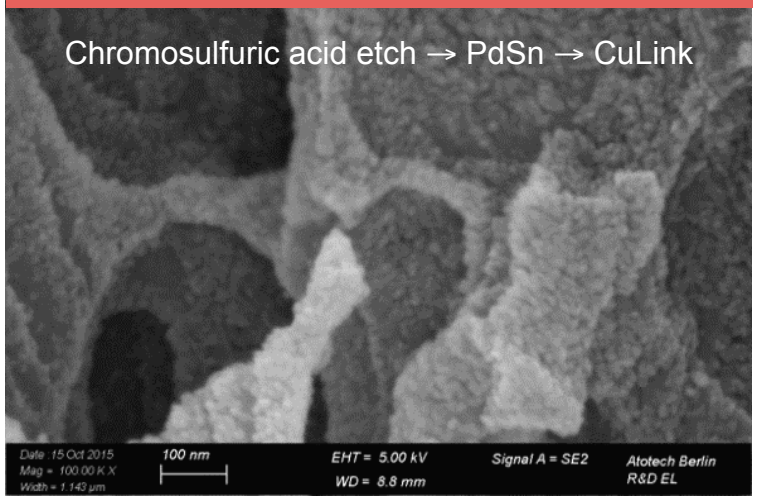
❶ Option: Cleaner, Pre-wetter, Pre-Etch

❷ Option: Conditioner

Direct Metallization

Mechanism

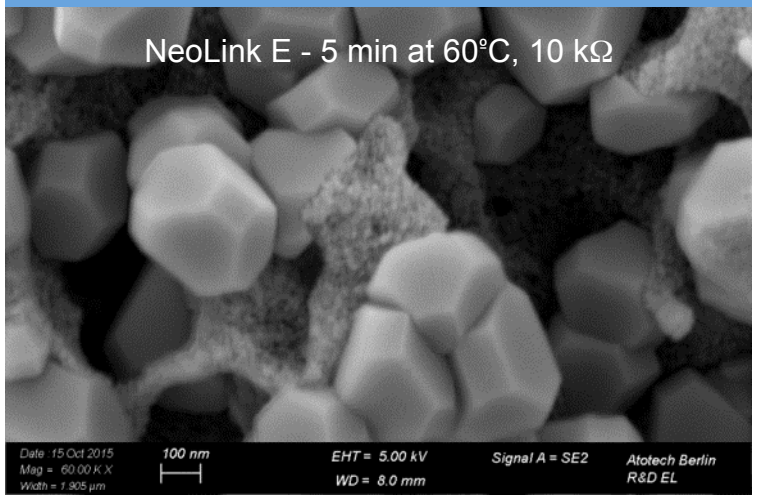
“Standard” CuLink



NeoLink® CuLink

- Immersion deposition Cu^0
- Very fine grain structure

NeoLink® E



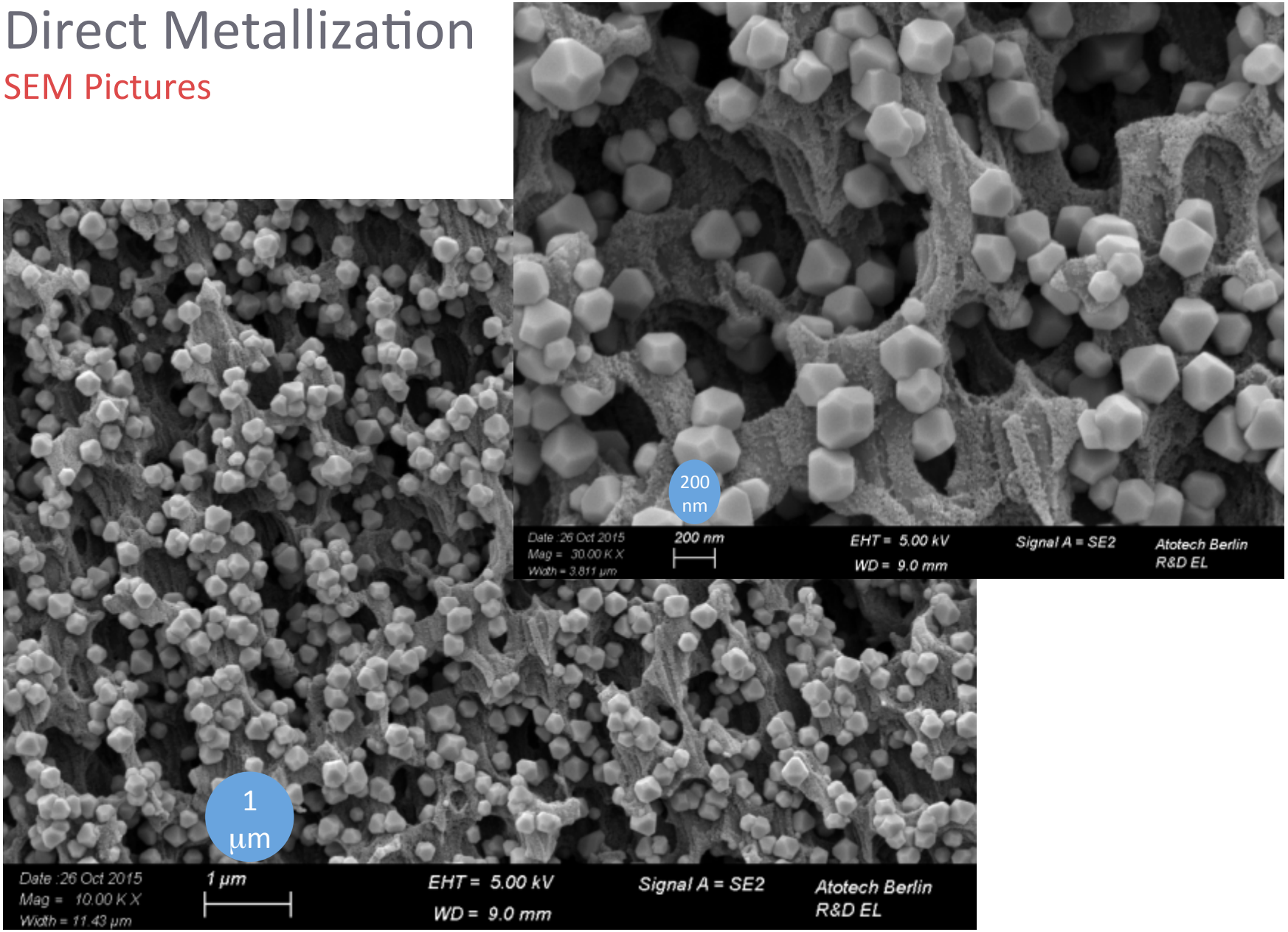
NeoLink® E

- Immersion deposition Cu^0
- Autocatalytic growth of Cu_2O particles (200 nm)

Conductive layer – Full coverage

Direct Metallization

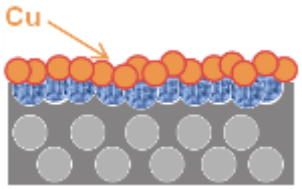
SEM Pictures

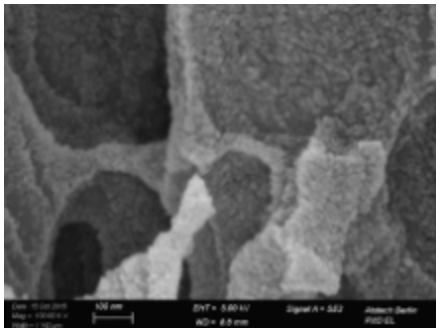


Direct Metallization

Principle Summary

"Standard" CuLink

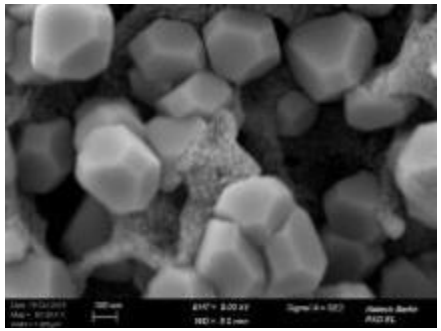


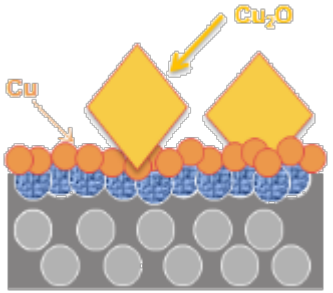


Sn-Cu exchange

Immersion deposition Cu^0

NeoLink® E





Sn-Cu exchange

Immersion deposition Cu^0

+

Autocatalytic growth of Cu_2O particles (200 nm)

Conductive layer – Full coverage

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Direct Metallization: NeoLink® E

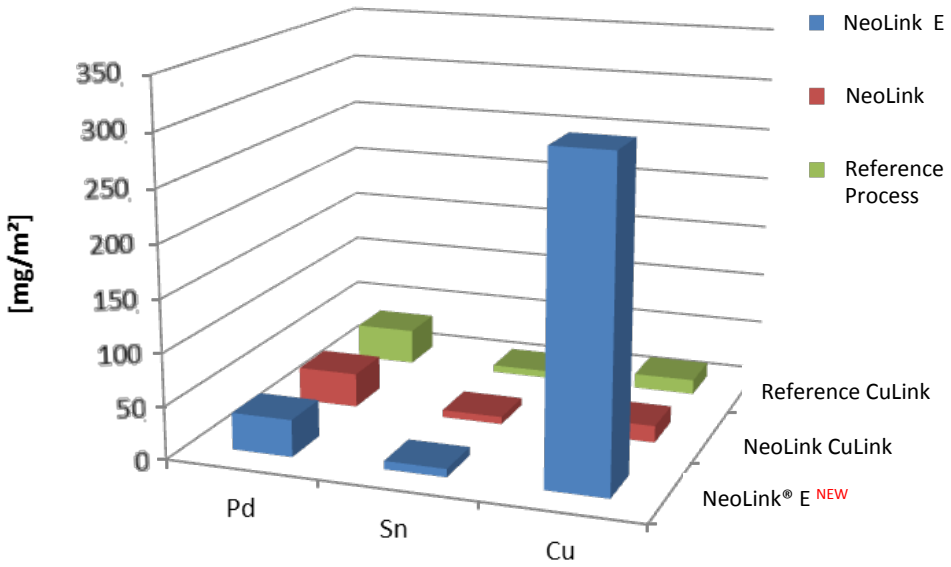
Test Results

High Conductivity / High Copper Adsorption

Results on ABS

High Copper Adsorption with NeoLink® E

- Comparison of ***Pd, Sn and Cu-adsorption**** values on ABS Novodur P2MC – activator: 3 min (40ºC) @ 40 ppm Pd on:
  - Reference CuLink
  - NeoLink® CuLink
  - NeoLink® E



*Note: adsorption is given as information only and cannot be used as reference/quantitative indication

Effect of NeoLink® E

Resistivity, Tin & Copper Adsorption

Palladium Activator @ 5 minutes 44°C

CuLink @ 5 minues 60°C

- Comparison of ***Pd-, Sn-, Cu- adsorption* and resistance**** on ABS+PC parts (BAYER T45):

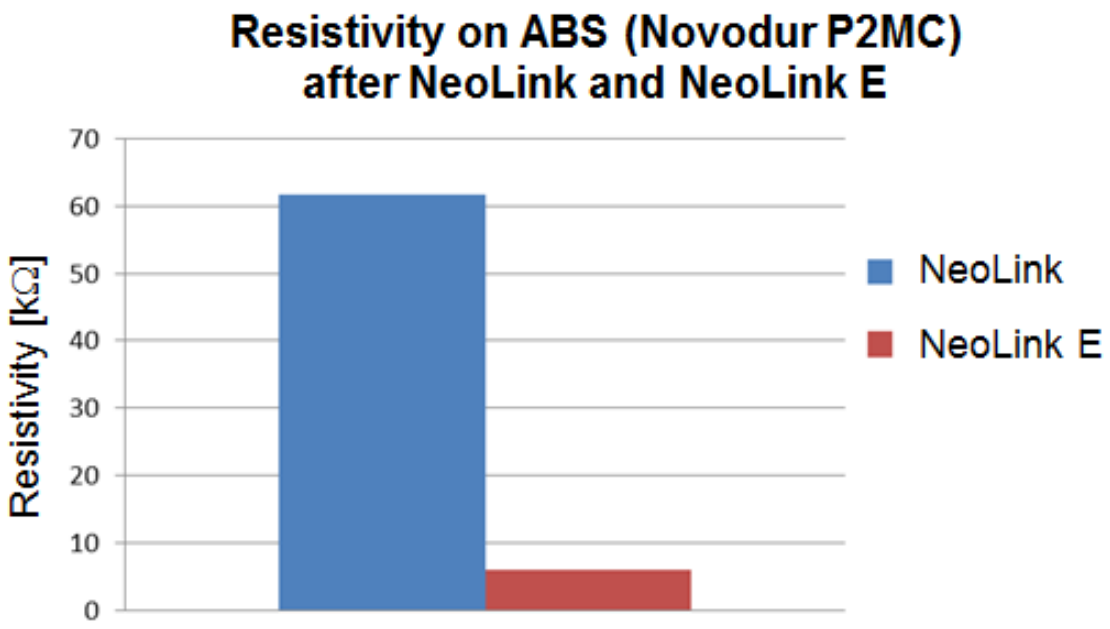
Activator parameter	NeoLink® E Activator – 5 min @ 44°C, different ppm Pd Mini Front Finishers (MFF)	Pd [mg/m²]	Sn [mg/m²]	Cu [mg/m²]
30 ppm Pd	after activator	36-42	33-38	0
	after Reference CuLink	36	6	9
	after Neolink E	38	8	285
50 ppm Pd	after activator	45-49	44-50	0
	after Reference CuLink	42	7	8
	after Neolink E	50	10	375

*Note: adsorption/resistivity are given as information only and cannot be used as reference/quantitative indication

Results on ABS

High Conductivity

- Comparison of ***resistivity**** of layers deposited on ABS after NeoLink® E and NeoLink® - Activator 3 min (40ºC) @ 40 ppm Pd:



*Note: resistivity is given as information only and cannot be used as reference/quantitative indication

NeoLink® E – Direct Metallization

Process Sequence for ABS & ABS+PC

NeoLink® E & Standard CuLink	Process Sequence, Time & Temperature
CrO_3-H_2SO_4 Etch	68°C – 10 minutes NeoLink® Additive CR
Reducer	30°C – 1 minute NeoLink® Reducer CR
Pre-dip	25°C – 1 minute HCl
Coll. Pd - Catalyst	40°C – 5 minutes NeoLink® Activator E
Copper Link	60°C – 5 minutes NeoLink® E

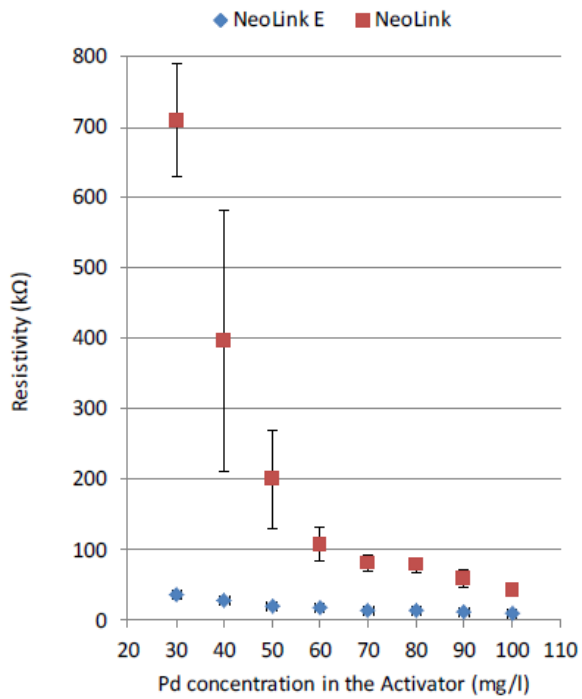
New!

Results on ABS & ABS+PC

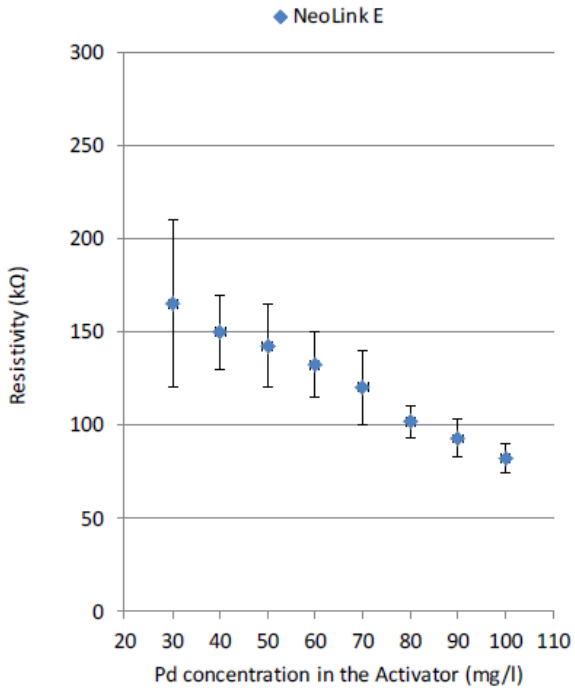
Low Resistivity/High Conductivity

- Comparison of ***resistance**** on ABS & ABS/PC after NeoLink® E

ABS Plastic Plaques



ABS + PC Plastic Plaques



*Note: Resistivity is given as information only and cannot be used as reference/quantitative indication

Direct Metallization: NeoLink® E

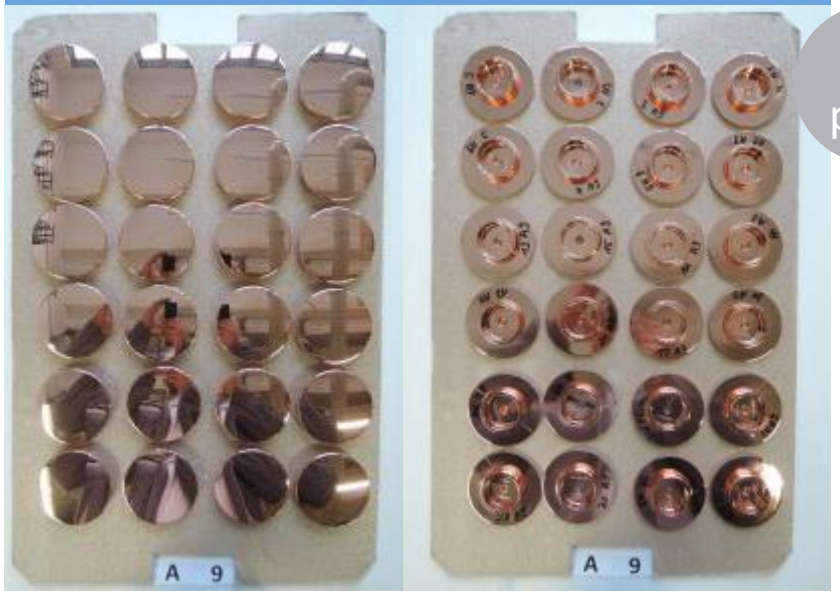
Results

Increased Coverage at Lower Pd Amounts

Results on ABS

Activator: 5 min (44ºC) @ 30 ppm Pd

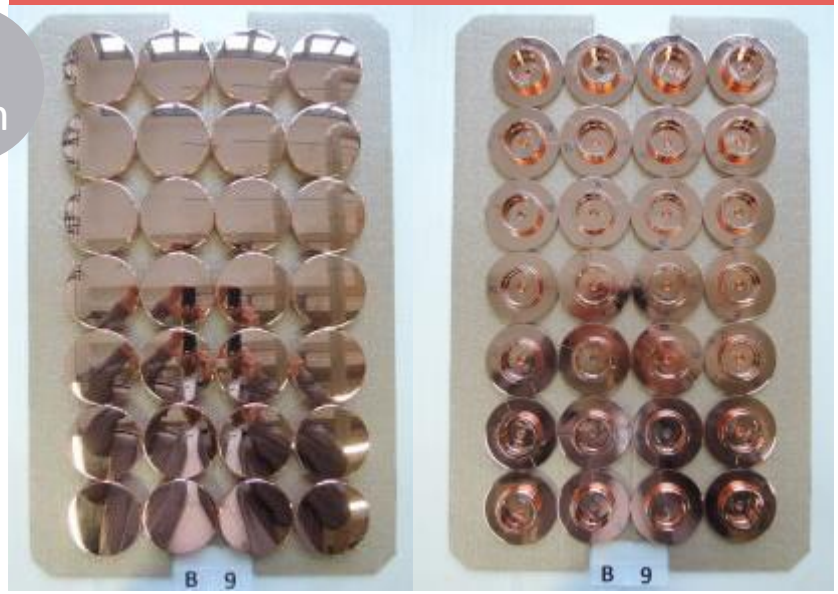
NeoLink® E



100% **Full coverage** FS/BS*
No flow lines

30 ppm

Reference process



Coverage: 100% FS* / 95% BS*
Light flow lines

*FS = Front Side, BS = Back Side

Results on ABS/PC

Activator: 5 min (44ºC) @ 30 ppm Pd

NeoLink® E

100% **Full coverage** FS/BS

30 ppm

ABS/PC
BB T45

Reference process

Coverage: 50-60% FS / 20-50% BS

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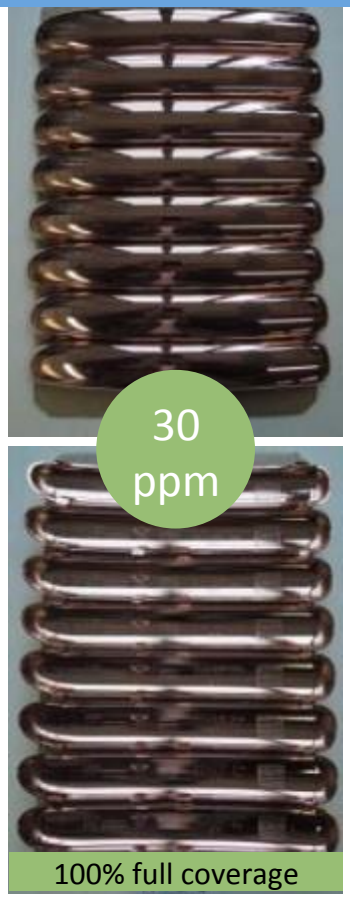
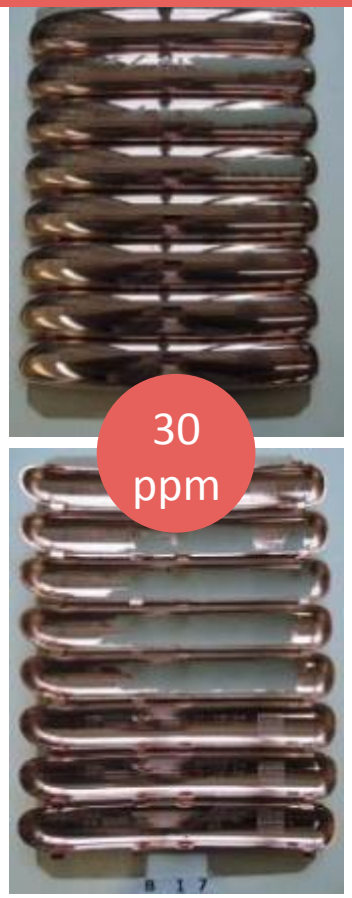
Results on ABS/PC

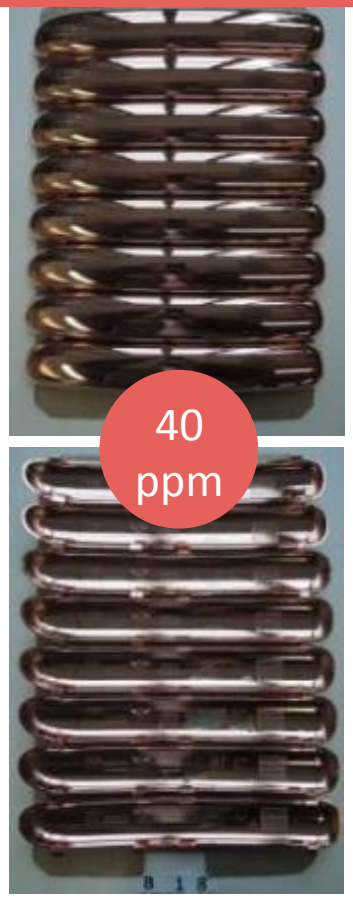
Activator: 5 min (44ºC) @ different ppm Pd

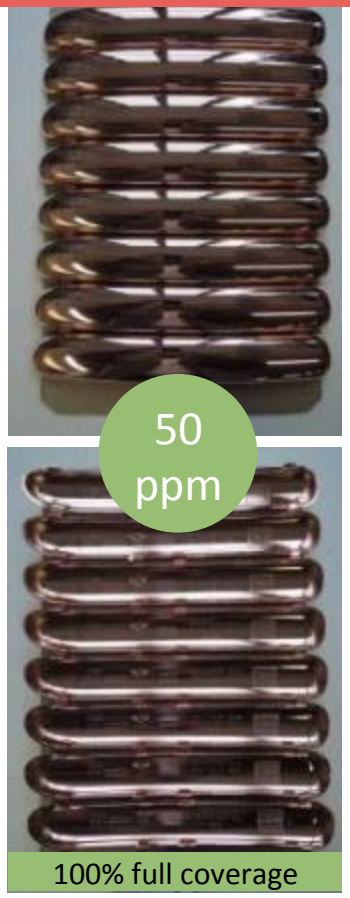
NeoLink® E



Reference process

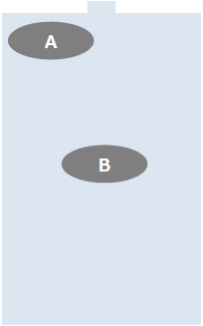


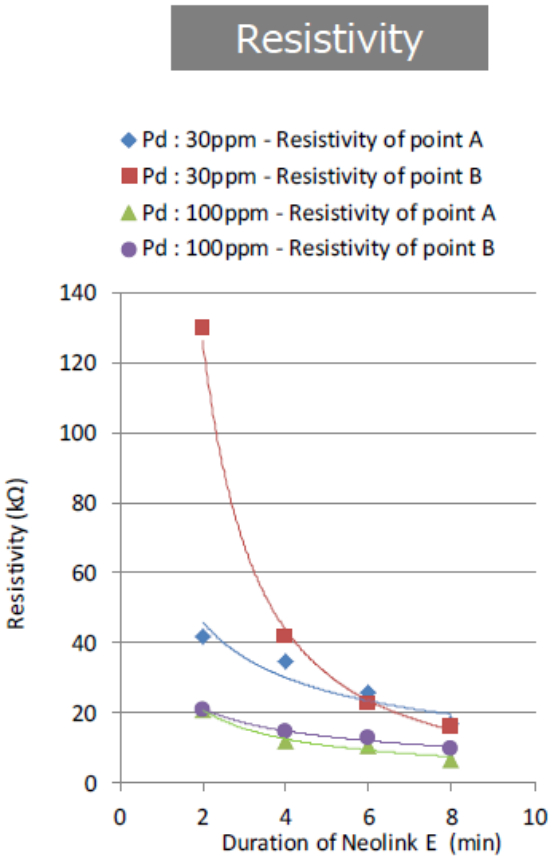


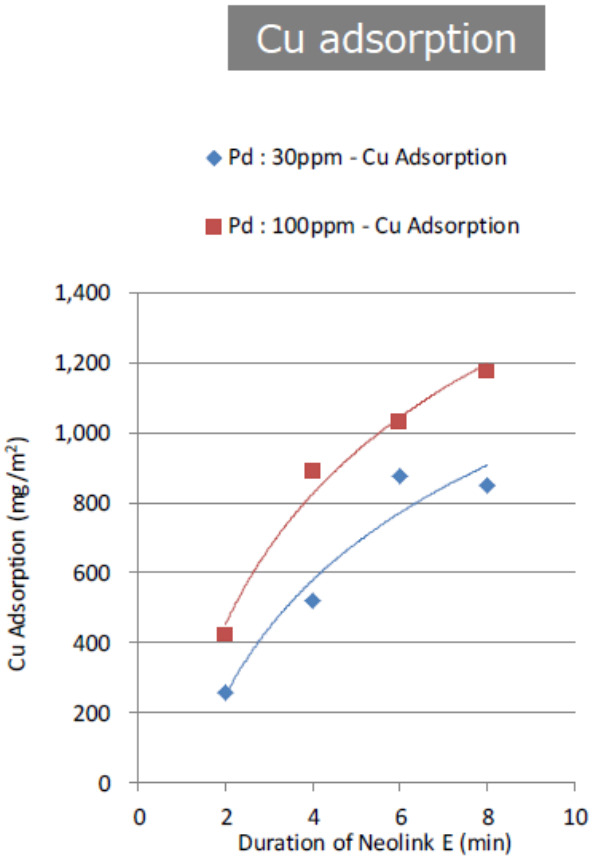


Effect of NeoLink® E – Immersion Time

Resistivity & Copper Adsorption – Palladium Activator @ 5 minutes 44°C







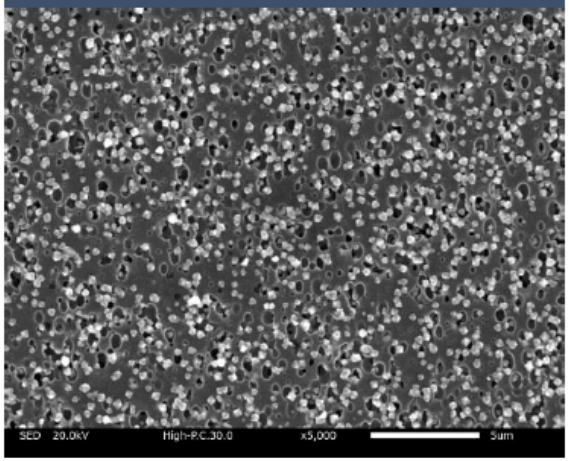
- Resistivity is decreased with an increased immersion time in NeoLink® E
- Copper Adsorption is increased with an increased immersion time in NeoLink® E

Effect of NeoLink® E – Immersion Time

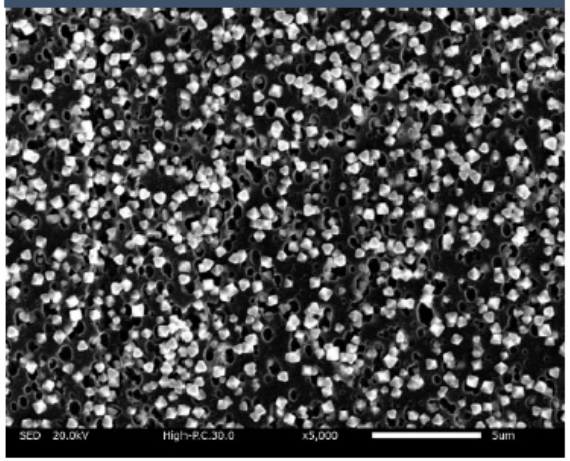
SEM 5,000 X Magnification

- ABS Plastic Substrate
- NeoLink® Activator: 5 min
- NeoLink® E: 2, 4, 6, 8 min
- No relative increase in particle size, Cu_2O, after 4 minutes only an increase in particle density

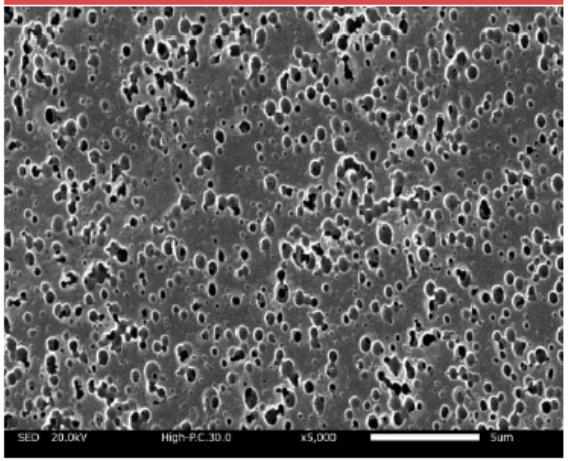
NeoLink E : 2min



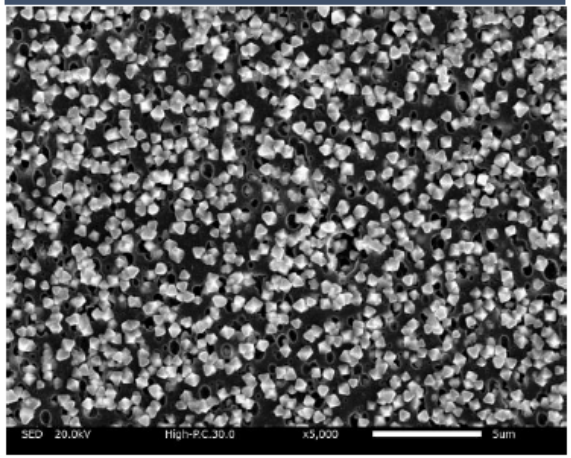
NeoLink E : 4min



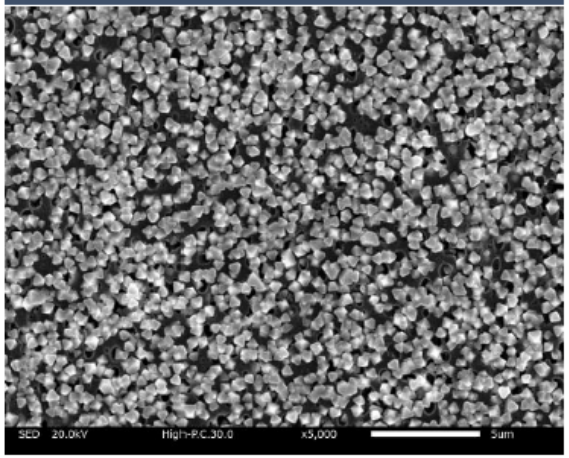
Reference Process



NeoLink E : 6min



NeoLink E : 8min



Direct Metallization: NeoLink® E

Results

Standard Adhesion

Adhesion

Standard Sequence with 30 – 40 Microns of Acid Copper Deposition

Actual Parts (Not Plaques)	**NeoLink® E**	**Reference Process**
ABS Cap	14.2 N/cm (8.1 lb/in)	14.8 N/cm (8.5 lb/in)
ABS/PC BMW Mini Front-Finisher	7.3 N/cm (4.2 lb/in)	7.2 N/cm (4.1 lb/in)

Comparable Adhesion

to the reference process & conventional EN

OEM Specifications for Adhesion	**ABS**	**ABS+PC**
General Motors – GMW 14668	9.0 N/cm (5.2 lbs/in)	4.5 N/cm (2.6 lbs/in)
FORD – WSS-M1P83-E2 2016	9.0 N/cm (5.2 lbs/in)	4.5 N/cm (2.6 lbs/in)
Volkswagon – TL 528 2015	7.0 N/cm (4.0 lbs/in)	3.5 N/cm (2.0 lbs/in)
Toyota – TSH6504G 2007*	9.8 N/cm (5.6 lbs/in)	9.8 N/cm (5.6 lbs/in)

*Note: Toyota does not make a distinction between ABS or ABS+PC substrates

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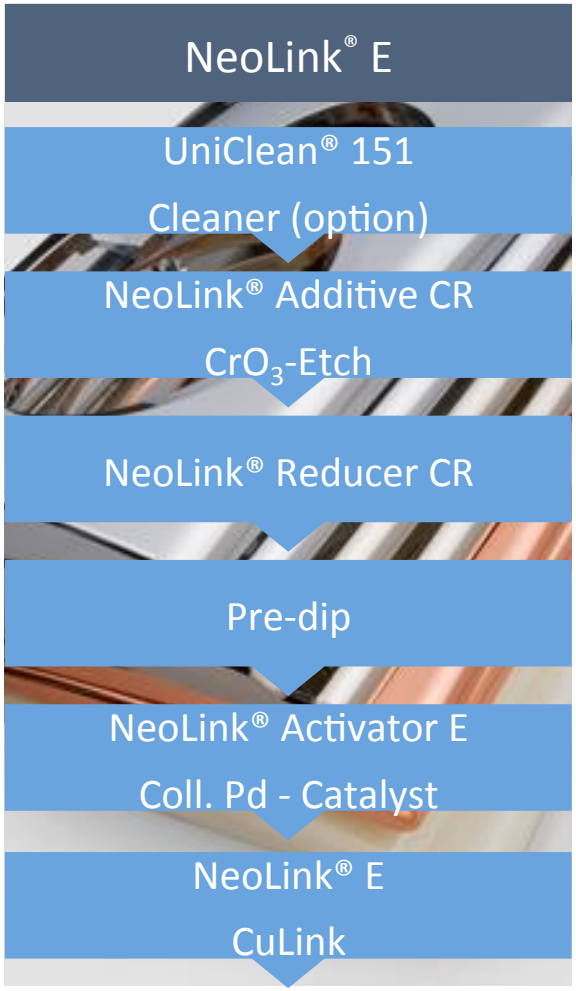
Direct Metallization

Summary

Direct Metallization: NeoLink® E

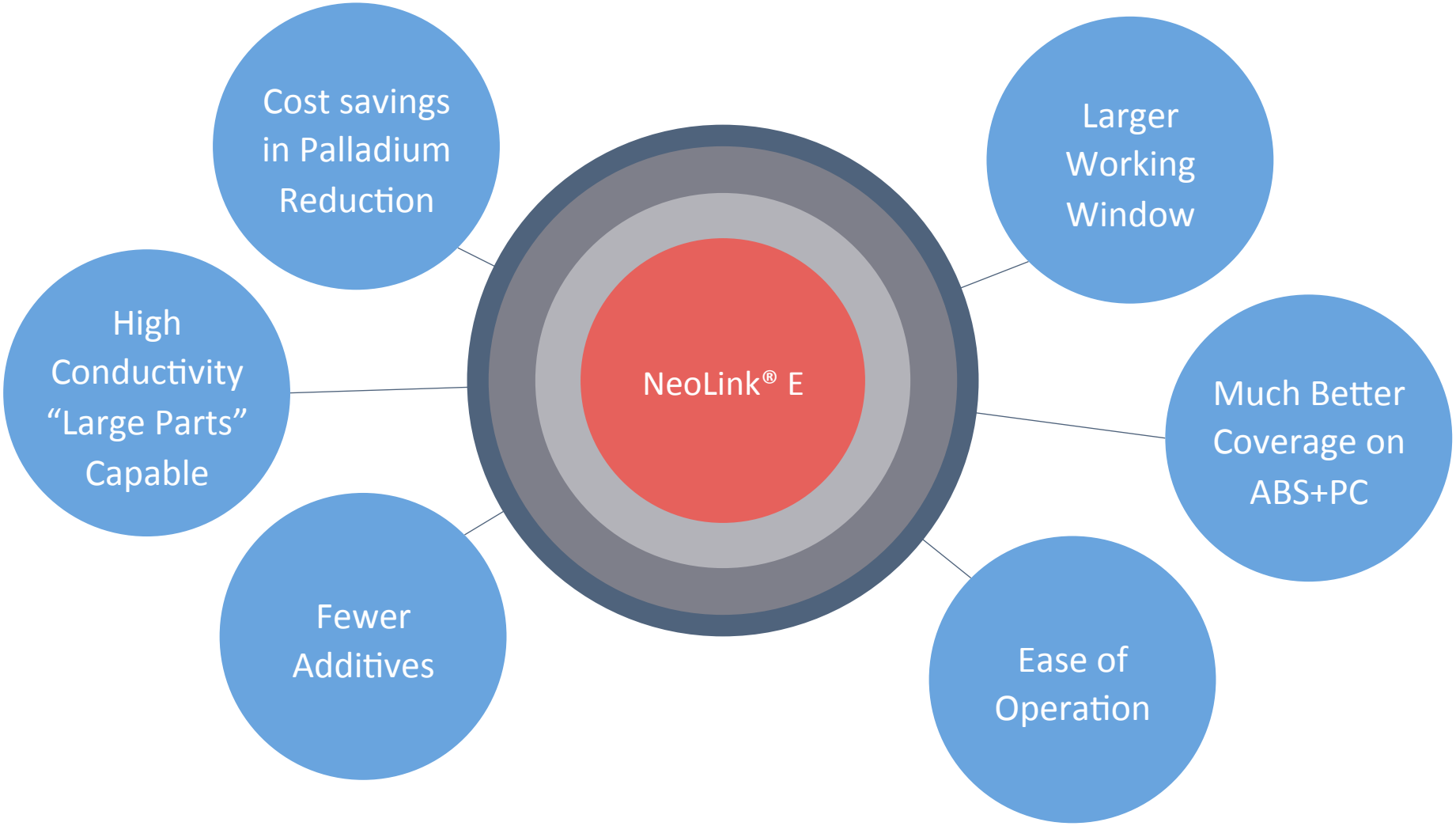
Main Features

- Similar costs to “Conventional EN Process”
- Significantly higher copper deposition on the plastic surface as copper metal and oxide
- No visible surface roughness due to Cu_2O cuprous oxide particles
- Higher conductivity/lower resistance of the surface prior to acid copper plating
- Excellent coverage in the acid copper
- Required Pd concentration in the activator is reduced compared to previous generations
- High stability without stabilizing chemicals
- Only 3 replenishment solutions required
- Easy to use
- Suitable for ABS and ABS/PC, also for large parts



Direct Metallization: NeoLink® E

In a nutshell



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Thank you

for your attention!

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Technology for tomorrow's solutions