

# SPCC Clean Panel Discussion

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**Where do the challenges lay** in the formulated clean world?

**Is collaboration** the key to success?

# Challenges for Formulated Clean

#1

## Technical

- Fragmentation
  - Each customer is different, each node is different
- Increasing complexity:
  - More materials, increased selectivity, lower defects
- Lack of relevant test vehicles and metrology
  - Only customer wafers tell the story
- Supply chain, quality and change control requirements tightening

#2

## Commercial

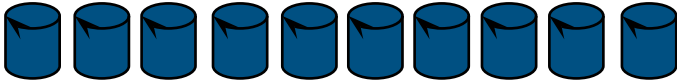

- Dilutions are increasing
- ASP Pressure intensifies
- Volume per solution significantly reduced

#3

## Competition

- Commodity chemicals
- Traditional competitors
- Customers
  - Increased activity in developing formulations and tolling
- OEMs
  - Driving down chemical consumption to improve CoO for tool sales
- Fast followers
  - Increasing numbers of local companies attacking N-2 business (28nm)

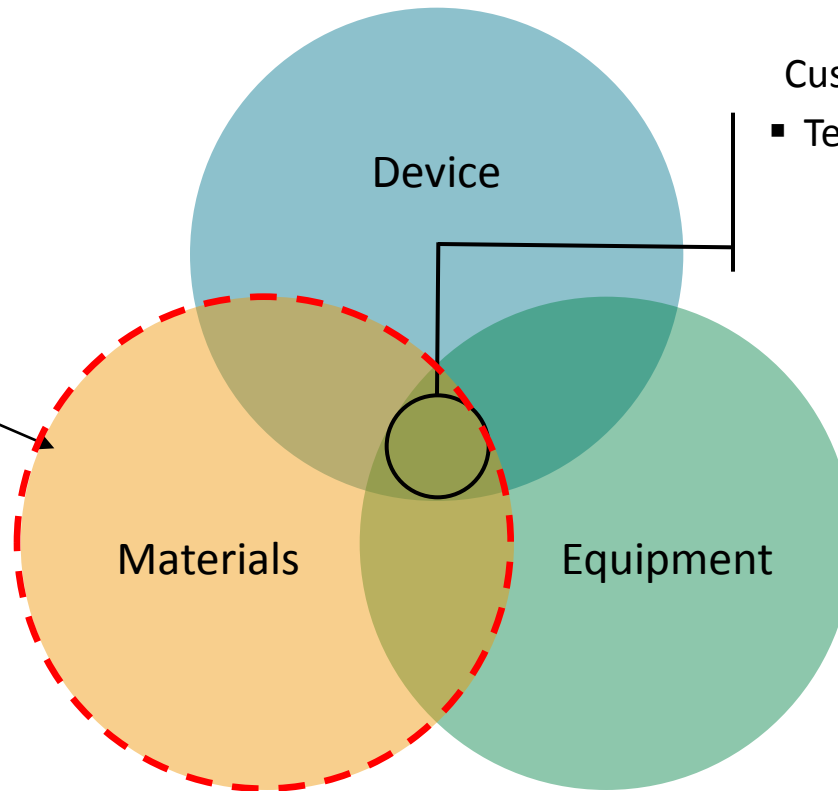
# Real World Example for PCMP Cleans

	Formulation A	Formulation B
First Sold	2000	2015
Customers	5	1
Fabs	13	2
Tech Nodes	130 – 28nm	10nm
CoA Parameters	~10	>45
Complexity	-	5x
ASP Expectation	-	-20%
Dilution	-	2x
Volumes		

# Success Depends on Increased Collaboration

Opportunity to “put the pieces together” in the materials space

- Advanced precursors, advanced surface preparation, novel doping
- Materials handling, sensing, and delivery components



Customers Care About:

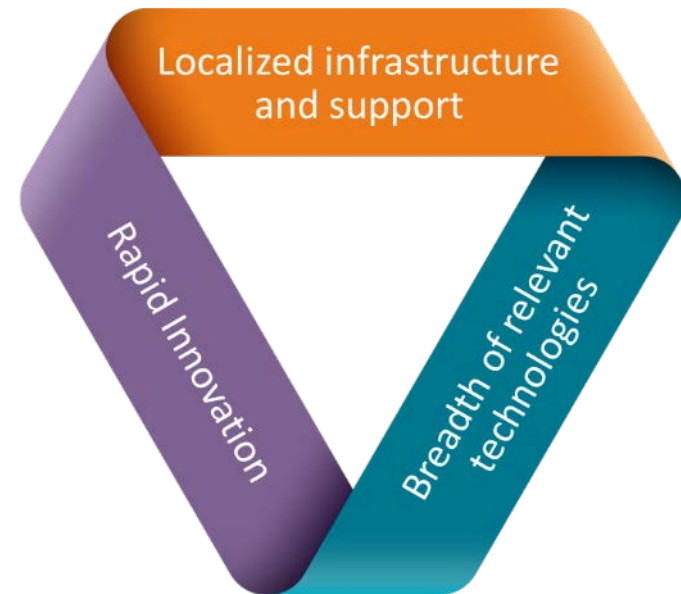
- Technology **Performance**
  - Process **Yield**
  - Device **Cost**

## Significant overlap within the Semiconductor Ecosystem

- Targeted collaborations are the key to profitable solutions for all parties

# Accelerating Development Cycles and Improving Yields

- Combine capabilities to unlock new value
  - Technical capability for rapid innovation
  - Breadth of technologies
  - Global reach, local support
- Enable new paradigms within the semiconductor ecosystem
  - Wet chemistries and wetted surfaces
  - Gases and gas-wetted surfaces
  - Solids and solid material delivery
- Create differentiated solutions to accelerate customer yield ramps



Enable the customers to focus on process integration and product performance

