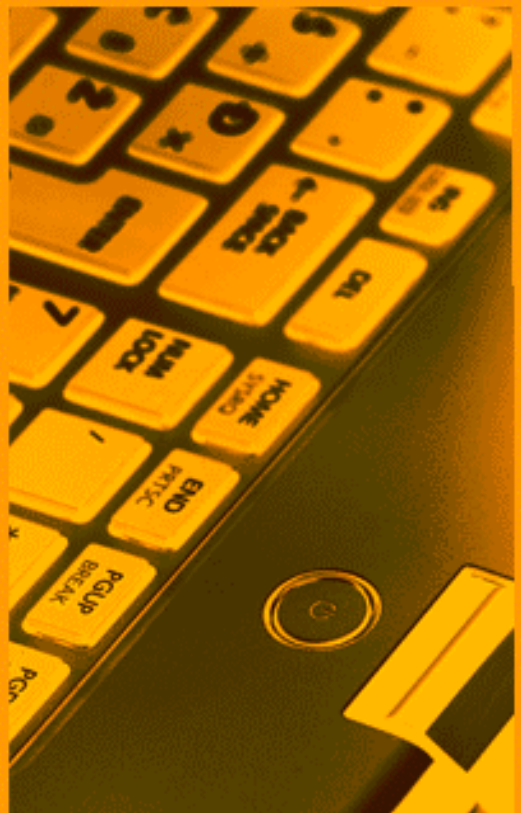
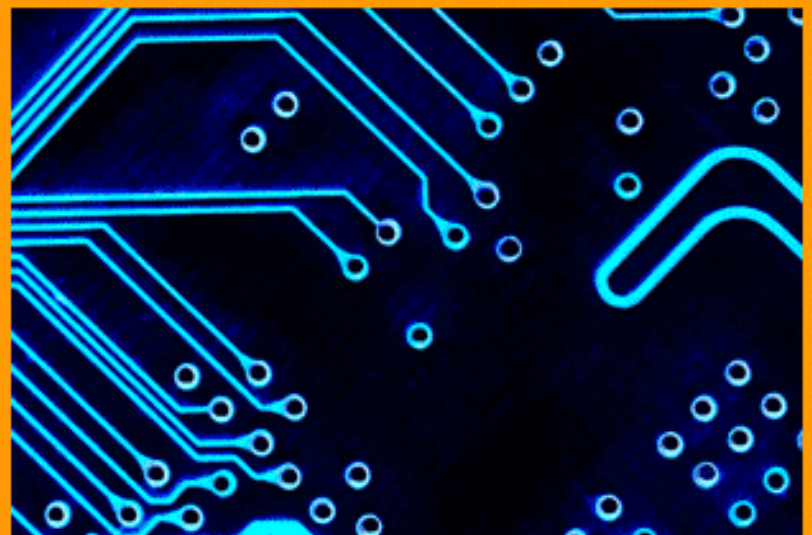
SGIA Printed Electronics Roundtable

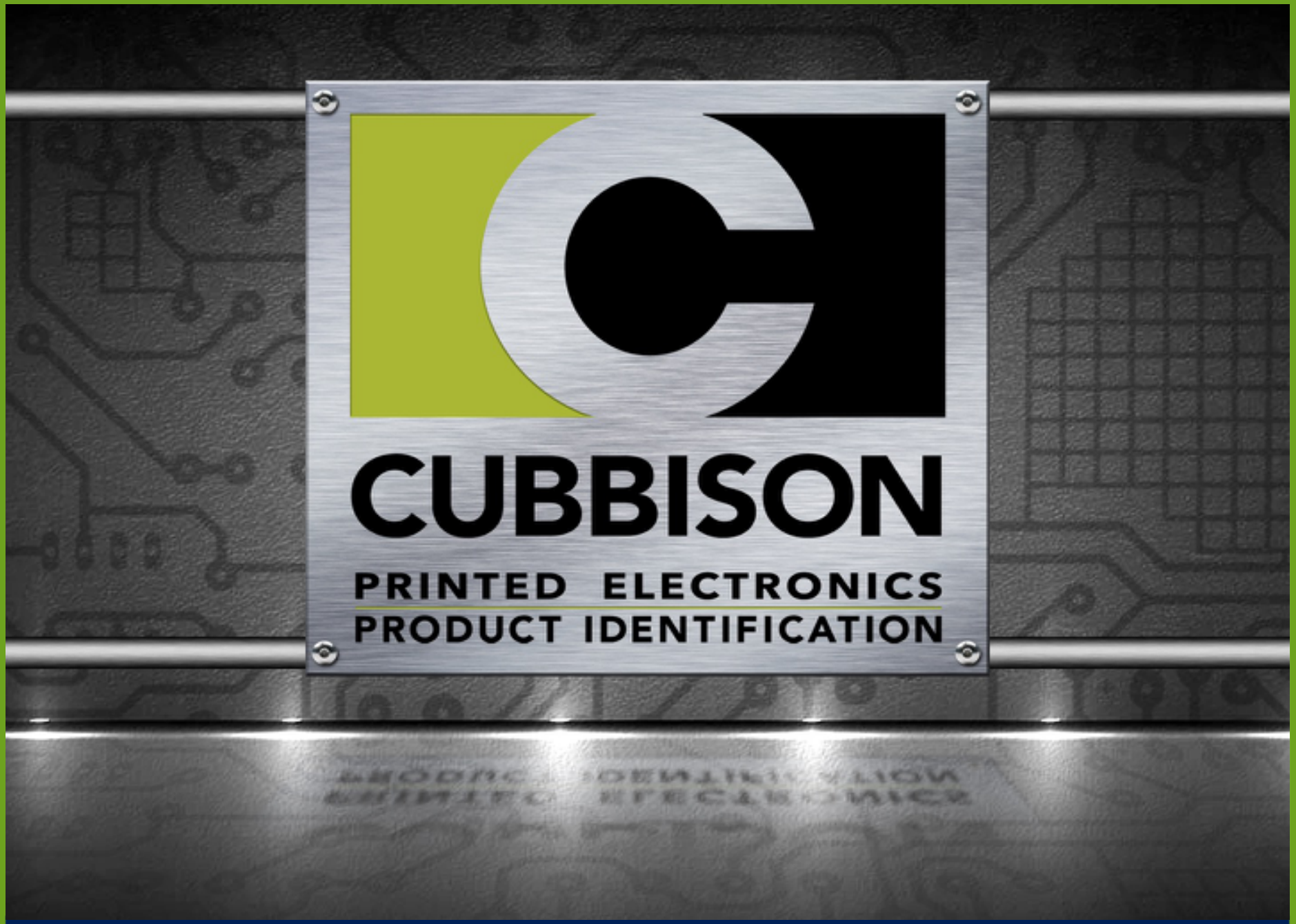











CUBBISON
PRINTED ELECTRONICS
PRODUCT IDENTIFICATION



R&D DOE

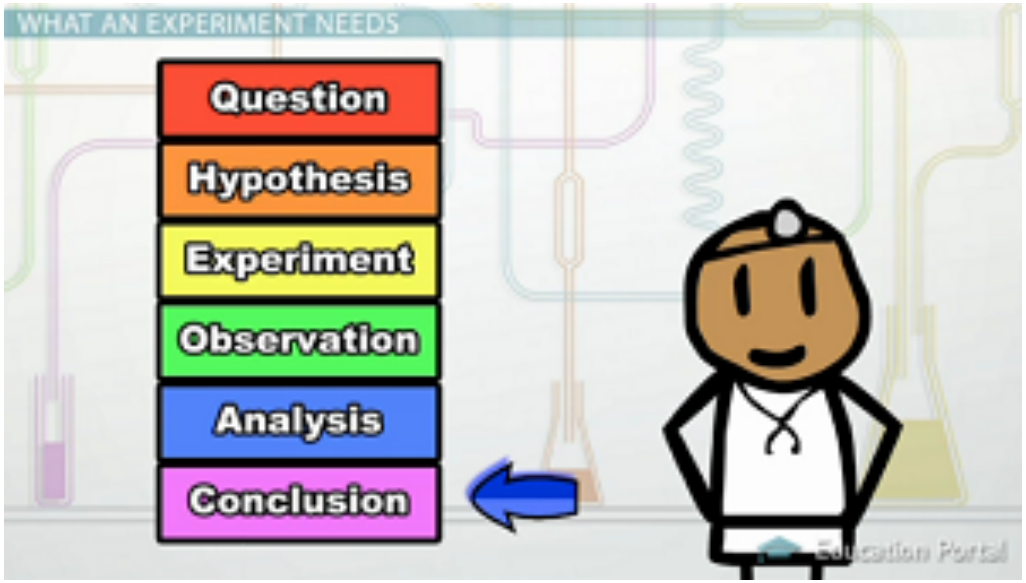
What are they and what do they do

R&D

- Research is typically an investigation of current knowledge about existing products in order to find a fresh idea for a new product. Such as Inks, Substrates and process.
- Development of the new or existing idea into a workable and saleable product

R&D To DOE

- Now that you have your idea and materials this is where you start your DOE



DOE “Design Of Experiment”

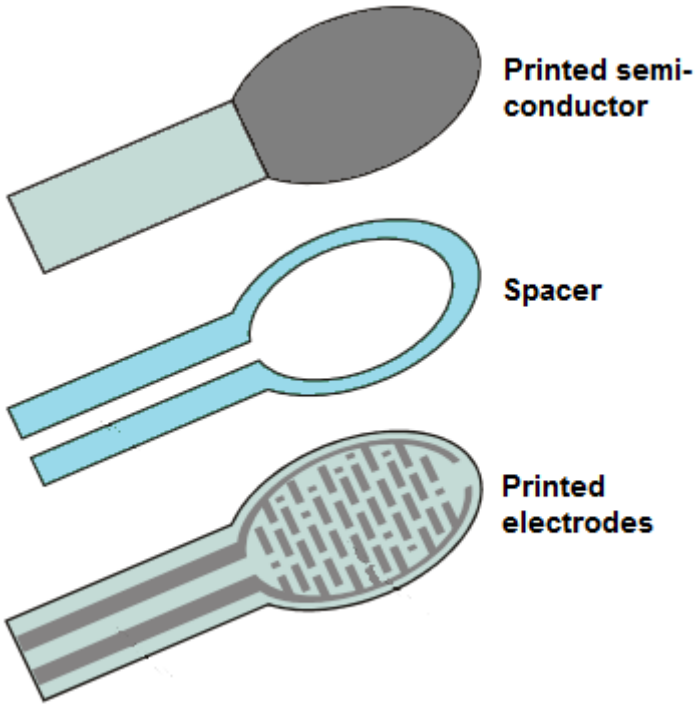
- A DOE is a planned approach to test a process or materials to produce a product. The testing is done in a non bias environment by non biased operators
- The testing should be done in a production setting by production employees



How R&D and DOE Work Together

- In this scenario we are going to look at an FSR application
- R&D, select the materials that you research to build your product. Ink, substrate, spacer material
- We have knowledge of the ink and substrate we want to use
- Variable is the spacer material
- We took an educated guess at what the spacer material should be based upon our past experiences

Basic FSR Design



R&D Into Production

- This is where you want to run a prototype or a pre-production run. Most people will run a 10 piece Prototype
- Evaluate your Prototypes
- Determine if a DOE is needed
- In our scenario, we need to do a DOE, we need less actuation force to actuate our FSR

DOE



DOE Thought Process

- Now for our DOE, we know that we have a good combination of ink and substrate. At this point we process the ink and substrate the same way every time
- Our variable is the spacer material between the FSR pads and the circuitry
- Layout your DOE
  - What are the different spacer materials and thickness you want to use
  - The different thickness of adhesives you want to use
  - As well as the opening in the spacer material

The DOE For Spacer Material

# Of Spacers	Material	Thickness	Adhesive	Thickness	Opening	Results
3 ea.	X	.003	X	.003	1”	X
3 ea.	X	.003	X	.003	.75”	X
3 ea.	X	.005	X	.003	1”	X
3 ea.	X	.005	X	.003	.75”	X

DOE Results

- Evaluate your DOE results
- Make your decision on what you want to change
- The results should give you a proper spacer build
- Next step: Pre-Production Run



Pre-Production Run

- This is where you repeat your process of printing, except, you increase your quantity to 100 pieces
- This will test your results of your DOE and see if you have any other issues that might occur during a production run
- In this scenario, we see that during our 100 piece run there are no issues with the inks or substrates we are printing on

Build Pre-Production Run

- This is where you build your 100 piece pre-production run then test it. You will use the same lot of inks and same production process
- You should use the same production employees, this eliminates variables



Test Pre-Production Run

- After your run, now test your pre-production run
- You want to number your sheets as you are producing them so you can see if there are any variables. This will show up during testing
- At this point your testing is done and all tested well
- You are now ready for production
- If you had failures then start your DOE over for your failure points. Retest!!

Different Approaches

- R&D then straight into production to find failures
- R&D and DOE together then into production
- R&D, Prototype then DOE and Prototype again
- R&D, Prototype, DOE then pre-production
- As you can see, there are many ways to get where you want to go but they all start with R&D. Which is the best? That is up to you, the person doing the R&D and DOE

Thank You

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