

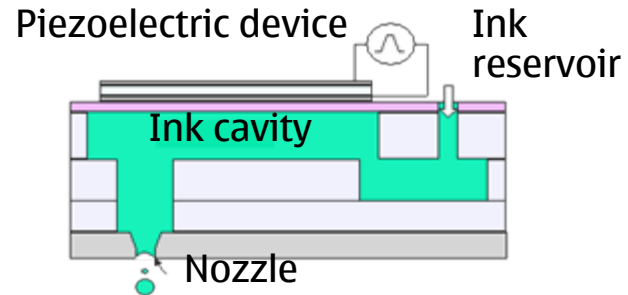
Challenges on applying printed electronics on mobile electronics devices

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Printing process for electronics integration

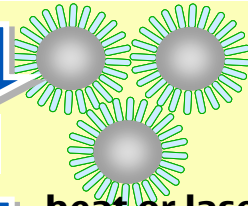
Ink jetting as an applying method



Printed ink, e.g. conductor



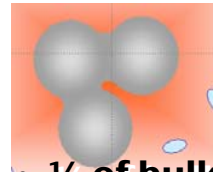
dotted pattern



Solid film



heat or laser treatment



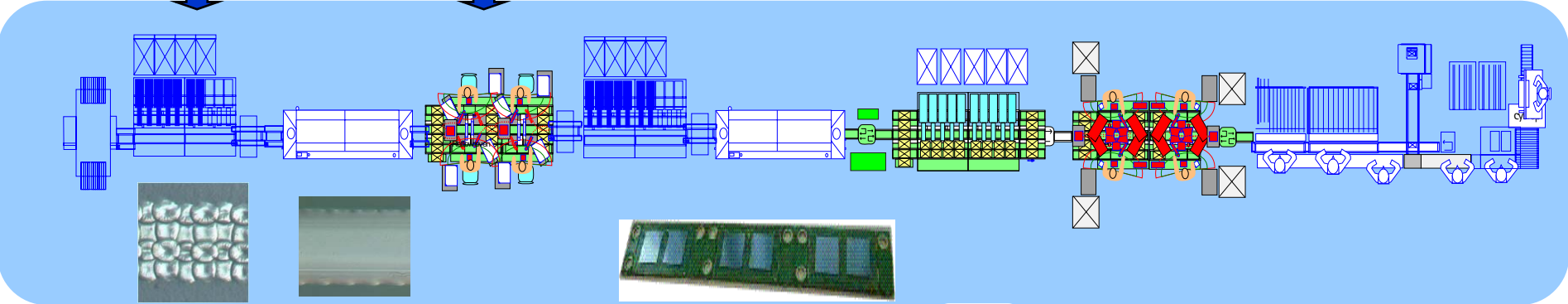
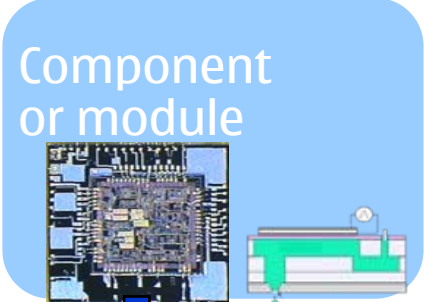
Joined IC



~ 1/2 of bulk metal conductivity



New way to manufacture



Loading

Printing

Curing

Assembly

Printing

Curing

Final assembly & testing

Labeling

Packaging

“Nano” issues (1/2)

- Inkjet manufacturing method
 - Narrow line width requirement → small dimension → “nano” forces →
 - low viscosity inks → lot of solvent → less functional material, flooding, surface treatments →...
 - ultrasonic pulses → high local heating → coagulation of nano particles → protective material layer →...
 - surface treatments → right materials and processes? →...
 - Drying of print heads → material modifications →...
 - ...→ right material combination with other materials and process steps
- Materials
 - In general
 - Shrinking compared to other materials used → requires modification of material properties → testing material combinations → time consuming
 - Several layers of shrinking materials → thick layers start behave as solid bulk materials → bending/cracking/de-lamination
 - Nano material modeling?

“Nano” issues (2/2)

- Dielectric materials
 - Low viscosity → more solvent → pin holes → modification of material properties → testing material combinations
 - Low adhesion → modification of material properties → testing material combinations
 - testing with manufacturing method
- Conductive materials
 - Sintering temperature of Ag particles saturates to ~220 °C around 2 nanometers. Something can be done with surface treatment, but not much.
 - 220 °C burns most commonly used materials
 - Modeling and experiments verify what literature and datasheets say
 - What can we do?
 - Local heating with laser → thermal flows
 - Radiation, if wavelengths and pulses are correct?
 - Chemical curing?
 - Some other process?

How to solve these issues?

- Materials and manufacturing process must fulfill the requirements of the application
- Materials must fit to the manufacturing process, or the process must be changed for materials
- Materials need to behave correctly with other materials
- Nano phenomenon and nanomaterial properties & behavior are not widely understood outside research labs
- Modeling tools not widely available
- How can anyone benefit from nanotechnology when so many issues are open?
 - Set and share your vision
 - Invite others to solve your challenges
 - Join to consult others
 - Build competence and supply networks
 - Apply it where it makes sense for your business

Thank you!