Printed Electronics Roundtable
Flexible Hybrid Electronics (FHE) Assembly

Xiaoying Rong, Ph.D.
Graphic Communication Department
Cal Poly State University
Flexible Electronics

• Flexible PCB
  • Flexible substrate can withstand higher processing temperature – Polyimide

• Flexible electronics
  • Bendable
  • Stretchable
  • Low temperature substrates – PET, PEN, TPU
Challenges

• Interconnection methods
  • Solder
  • Electric conductive adhesives
• Suitable for printed material
  • attach on printed silver ink vs. attach on copper surface
• Temperature tolerance
  • Flexible substrates work with lower temperature
Interconnects

- Solder
  - Most common but limited to thermal stability of low cost substrates
  - Reflow temperature 240-265°C for Sn-Ag-Cu
  - Low temperature solder such as Sn-Bi reflow under 175°C

Interconnects

- Adhesive jointing
  - Isotropic conductive adhesives (ICA)
  - Anisotropic conductive adhesives (ACA)
- Higher resolution
- Higher mechanical flexibility

Common Binding Problems

• Incompatible between bumps and printed silver ink
• Insufficient contacts between adhesives and printed silver ink due to rough printed surface

Thesis, Bendability of flip-chip attachment on screen printed interconnections, LYDIA LEPPÄNEN
Reliability – Conductive Traces

- Bending and stretching
- Thermal and humidity reliability
  - Deformation
    - Thermal and humidity cycles can cause delamination
  - Could happen at different contacting points

Thesis, Bendability of flip-chip attachment on screen printed interconnections, LYDIA LEPPÄNEN

Scanning Electron Microscopy, Chapter 25, Study of Structure and Failure Mechanisms in ACA Interconnections Using SEM
Thin Chips

- For flexible hybrid electronics, chip thickness is one of the determine factors
- From 300-1000µm thin to 10-30µm
- By wafer thinning process or build on polymer surface
Assembly by Industrial Equipment

• Evaluating MRL level of assembly methods

Current Research

• Reliable and cost effective wafer thinning processes
• Industrial scale assembly processes
• Choice of chips with processable pitch configuration for both reliable printing and assembly
• Reliability of assembly for stretching and bending
• Collaboration among material development, printing, wafer processing and assembly – Cal Poly, Jabil, DuPont on a NextFlex grant

Marks, et al. 2015