Project Proposal

Cu Wire Bonding Reliability – Phase 3 Planning Webinar

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Background

- **Problem Statement**
  - Work of the iNEMI Cu wire reliability project identified that bonding quality and component reliability can be affected by source of the wires (i.e. vendor and characteristics of the wires).
  - Specifically, Pd-coated wires showed variations in reliability performance and it was suspected Pd-distribution within the FAB and ball bond played a role.
  - This needs to be investigated and validated; And if true, root cause needs to be understood.
  - In addition, new Cu wire types and Ag-alloy wires are increasing in adoption. Processing capability and reliability performance of these wires need assessment as well.

- **Opportunity**
  - This iNEMI project has established a collaboration team that delivered results. It would be a natural progression to move on to further in-depth evaluations.

- **Goal**
  - Investigate and understand root cause of variation in reliability of various Cu and Ag wire types.

IS / IS NOT Analysis

This Project **IS**:	This Project IS **NOT**:
Provide initial analysis of what the Project IS and IS NOT	
Assessment of effects of wire types on component reliability	Comprehensive evaluation of all package types and packaging material sets
Provide comparison of performance of different wire types and compare with Au wires	Endorsement of one vendor over another; Performance differences are also limited to the wires selected by this project and cannot be extrapolated to other types.
Use only biased HAST as reliability performance output	Will not include any other tests

iNEMI Statement of Work

- **Purpose of Project**
  - Understand key characters of various types of Cu wires and Ag wires that may impact alloy elements distribution, bond quality, and component reliability.
  - Understand key bonding process parameters that may impact alloy distribution, bond quality, and component reliability.

- **Scope of Work**
  - Only BGA package(s) will be included in this project. Multiple body sizes and packaging BOM may be included if deemed necessary by the team.
  - Only biased HAST will be used for reliability evaluation.
  - The output of the project will be a set of reliability testing results for the components using different wire types, bonding conditions, and packaging BOMs.

iNEMI Statement of Work

- **Business Impact**
  - Reduce the need and efforts for individual member companies to run evaluation on the reliability performance of various types of Cu wires and Ag wires.
  - Establish potential common requirements on wire materials properties and bonding process controls.

- **Outcome of Project**
  - Test results will be provided for all reliability tests, including electrical pass/fail data and all other failure analysis data.
  - An assessment of the reliability of various Cu bond wire and Ag wire types.
  - A result summary should be available to all iNEMI members in reports from this project.

Detailed Project Planning

- **Task 1 – Evaluation Matrix Definition**
  - Discuss and finalize evaluation test vehicle and experiment matrix.
  - Package Type: BGA
  - Wire diameter: 1.0 or 0.8 mil

Wire Type	Wire Characteristics (Pd thickness, etc.)	Bonding Process	FAB Characterization	Ball Bond Characterization
Au				
Pure Cu	4N Cu			
Pd-Cu		Process 1		
		Process 2		
Pd-Cu with Au Flash		Process 1		
		Process 2		
Alloyed Cu				
Alloyed Ag type1 (high Ag content)	94% Ag purity	Process 1		
		Process 2		
Alloyed Ag type2 (low Ag content)	86% Ag purity	Process 1		
		Process 2		

- Green Mold Compound
  - pH, Cl, S, ion catcher, Tg, etc
- Reliability Test:
  - HAST 130C/ 85RH%, 5V or higher

Detailed Project Planning

- **Task 2 – Component Assembly**
  - Determine assembly sites and process variations.
- **Task 3 – Reliability Testing**
  - Determine testing facilities and durations
- **Task 2 – Failure Analysis**
  - Determine FA techniques, facility, and expected outcome.

Schedule

Phase3	Months											
Tasks	1,2	3,4	5,6	7,8	9,10	11,12	13,14	15,16	17,18	19,20	21,22	23,24
1. Finalize resource & DoE												
2. Materials sourcing												
3. Assembly components												
4. Test boards design & manufacturing												
5. Reliability Test												
5.1. MSL3												
5.2. HAST												
6. Failure analysis												
7. Summary report												

Resource in-kind Contribution

Please input "**Yes**" for those items below that your firm plans to provide in-kind support to this project.		
	Resource / Capability Needs	**In-kind Contribution**
Material	Bonding Wire (Au, 4N Cu, Cu/Pd, Ag Alloy, Cu Alloy)	
	Die Daisy Chain	
	Substrate	
	Mold Compound (low Chlorine type)	
Test Boards	Design	
	Test board fabrication	
Assembly	BGA Assembly	
HAST Test	Pre-Condition (Level 2.5)	
	HAST (130/85 – 5.5V)	
	Failure Analysis	
	Cross Section Observation	
	SAT (C-Scan/ T-Scan)	
	X Ray Inspection	
	Decap (SEM)	
	EDX (Ball to Pad)	
	AES (crack area)	
	Optical Image on the Bonded Ball/Pad Area	
Input others not in the list but you recommend		

Note: Final material selection, test vehicle design as well as who do what will be reviewed and decided by the project team.

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