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IPC-TM-650 2.4.53 染色(Dye)和拉力(Pull) 测试方法解析

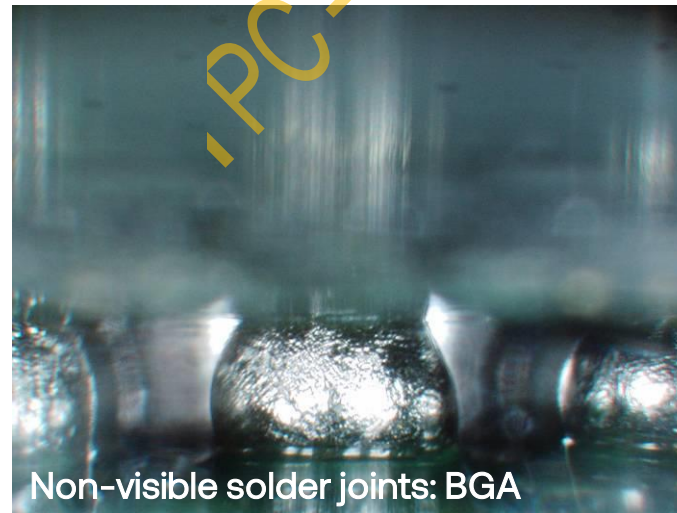
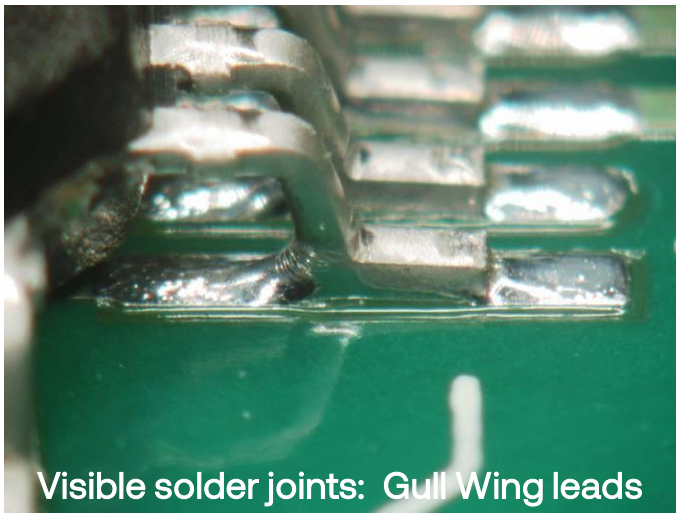
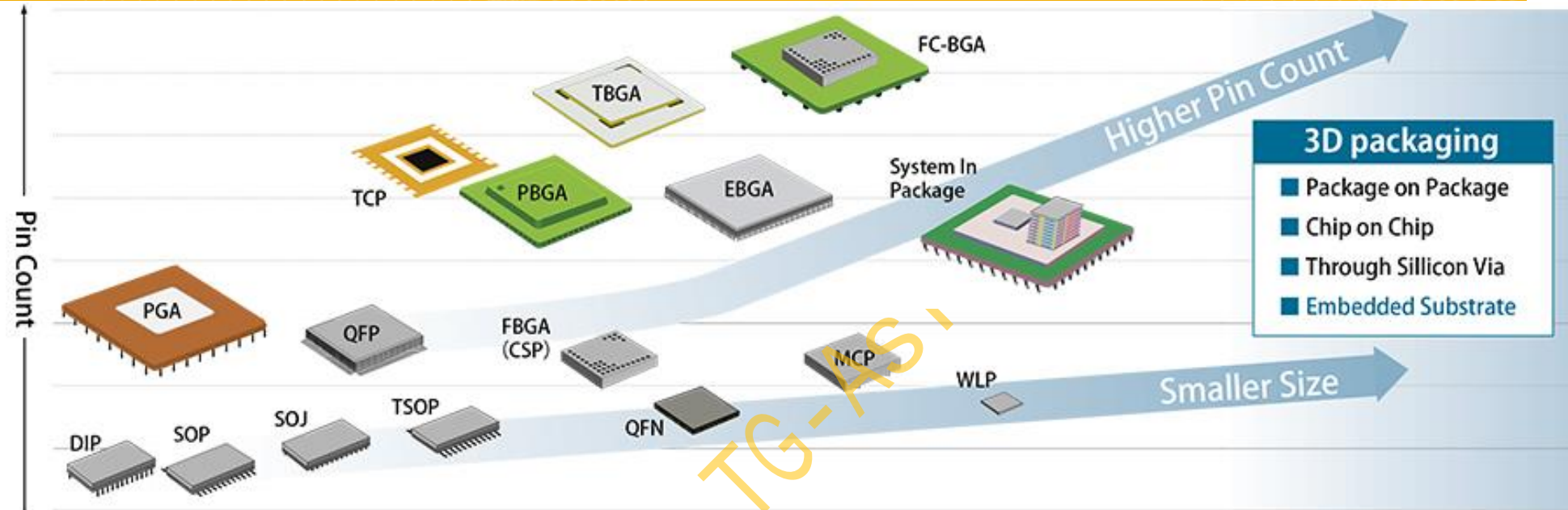
德凯亚太区昆山实验室 陈彦奇

2023/7/6

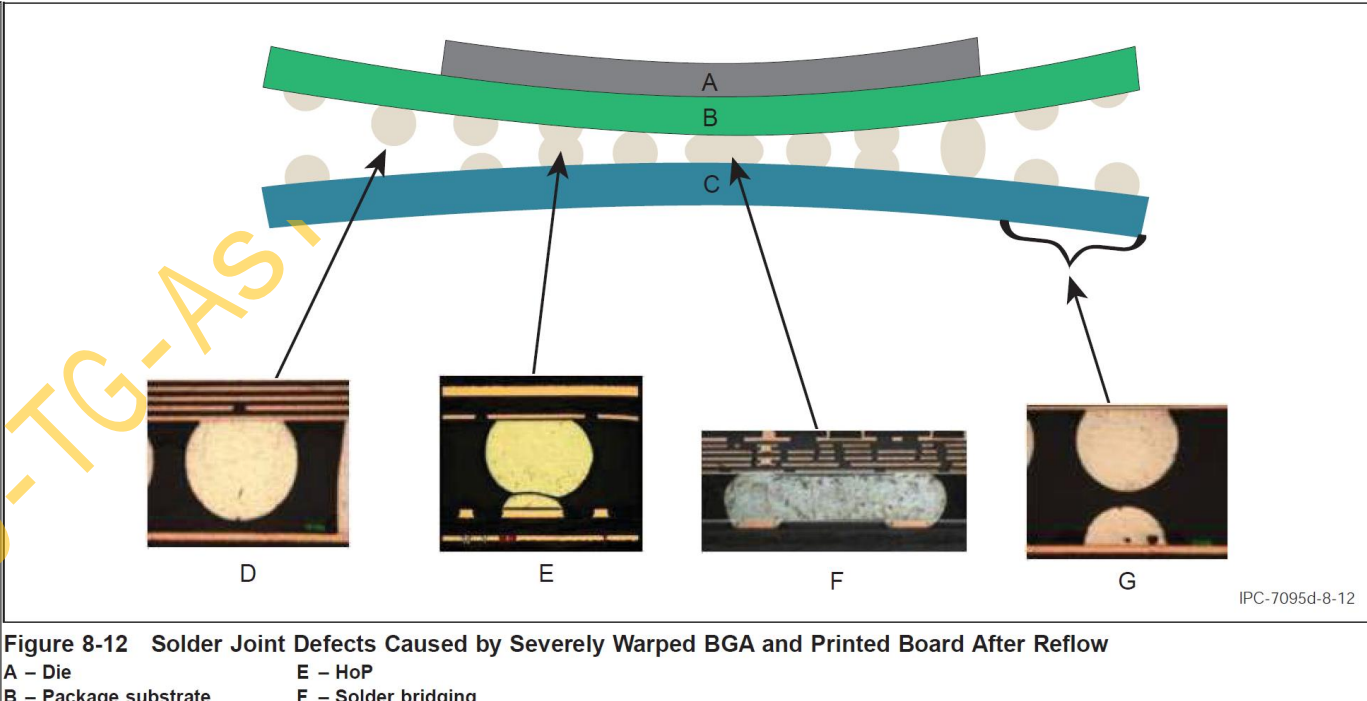
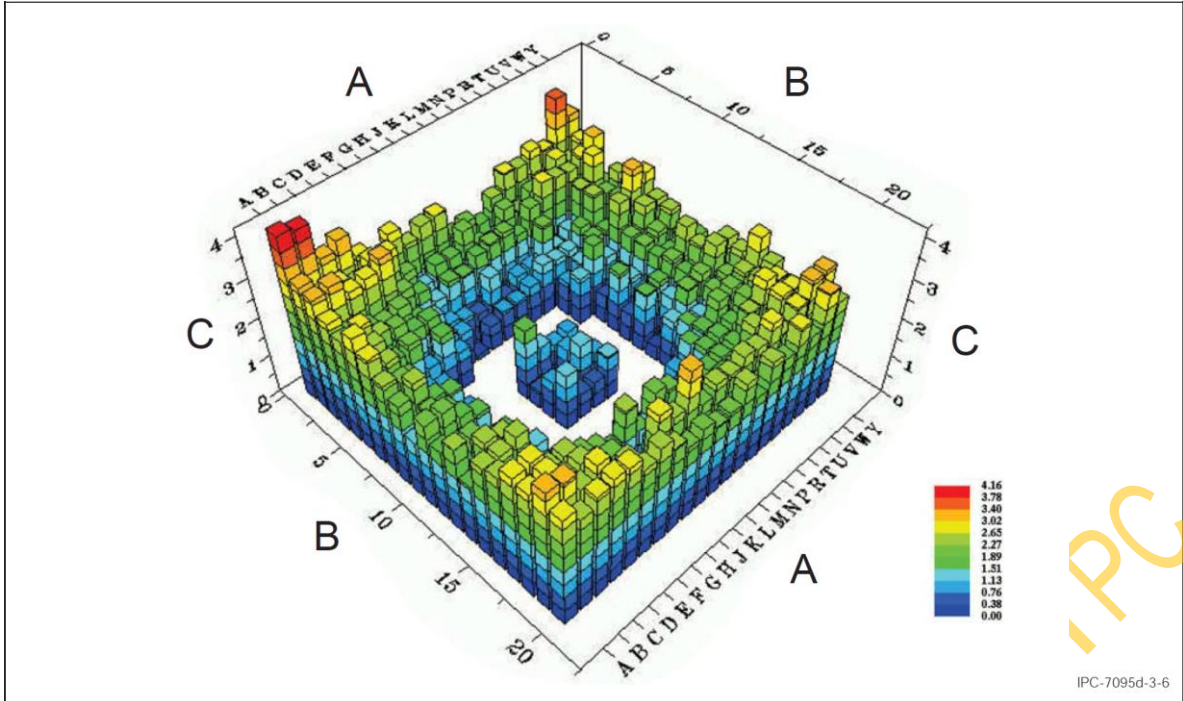


ipc.org →

表面贴装组件的可视焊点与不可视焊点封装演进



不可视焊点在焊接中的潜在风险 (共面性与动态翘曲)



8.3.12 表面贴装面阵列: X光检查 (不能用普通目视检查方法时)

IPC-A-610

Revision H – September 2020

Supersedes Revision G

October 2017

Acceptability of Electronic Assemblies

8 Surface Mount Assemblies

8.3.12 Surface Mount Area Array

Some examples of area array components are BGA, Micro-BGA and Column Grid Array.

Area array criteria defined herein assumes an inspection process is established to determine compliance for both x-ray and normal visual inspection processes. To a limited extent, this may involve visual assessment, but more commonly requires evaluation of x-ray images to allow assessment of characteristics that cannot be accomplished by normal visual means.

Nonconformance to the requirements of Tables 8-13, 8-14 and 8-15 are defects when visual inspection or x-ray inspection is performed to verify product acceptance.

Visual inspection of the solder terminations on the outside row (perimeter) of the area array component should be performed whenever practical.

Solder balls or columns shall not be absent unless specified by design.

Voiding criteria for components with noncollapsing balls are not established, see 1.5.1 Acceptance Criteria.

Alternative criteria for voiding may be developed between Manufacturer and User, see 1.2 Purpose.

Table 8-13 Dimensional Criteria – Ball Grid Array Components with Collapsing Balls

Feature	Clause	Classes 1,2,3
Alignment	8.3.12.1	Solder ball offset does not violate minimum electrical clearance.
Solder Ball Clearance (C), see Figure 8-146	8.3.12.2	Solder ball does not violate minimum electrical clearance.
Soldered Connection	8.3.12.3	No solder bridging; BGA solder balls contact and wet to the land forming a continuous elliptical round connection.
Voids	8.3.12.4	30% or less voiding of any ball in the x-ray image area. Notes 1 and 2.

Note 1. Design induced voids, e.g., microvia in land, are excluded from this criteria. In such cases acceptance criteria should be established between the Manufacturer and User.

Note 2. Plating process induced voids, e.g., champagne voids, are excluded from this criteria. In such cases, the acceptance of the voids will need to be established between the Manufacturer and User.

Table 8-14 Ball Grid Array Components with Noncollapsing Balls

Feature	Classes 1,2,3
Alignment	Solder ball offset does not violate minimum electrical clearance.
Soldered Connections	a. Solder connections meet the criteria of 8.3.12.3. b. Solder is wetted to the solder balls and land terminations.
Voids	Voiding criteria are not established.

Table 8-15 Column Grid Array

Feature	Class 1	Classes 2,3
Alignment	Column offset does not violate minimum electrical clearance.	Column perimeter does not extend beyond the perimeter of the land.
Solder connections	Meet the criteria of 8.3.12.3.	Minimum 270° circumferential wetting for the portions of the columns that are visible, see Figure 8-151.

Developed by

BUILD ELECTRONICS BETTER

participants from 29 countries contributed to this standard

8-86

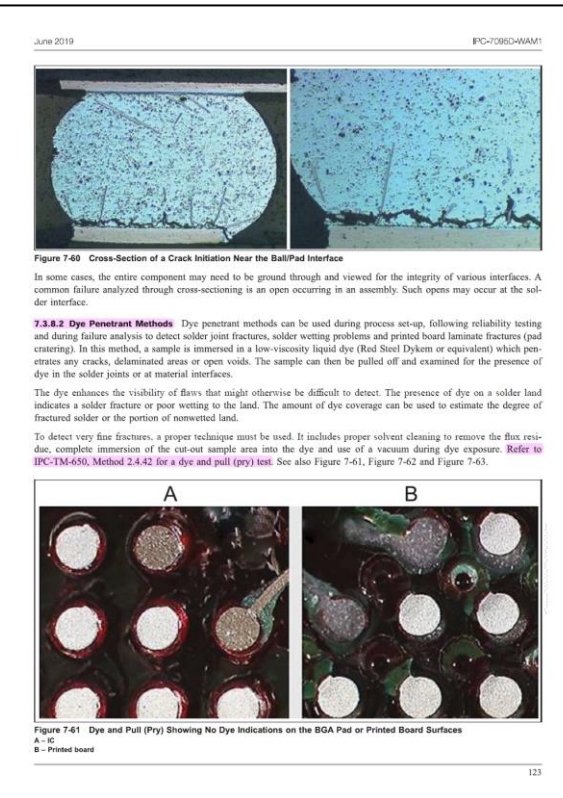
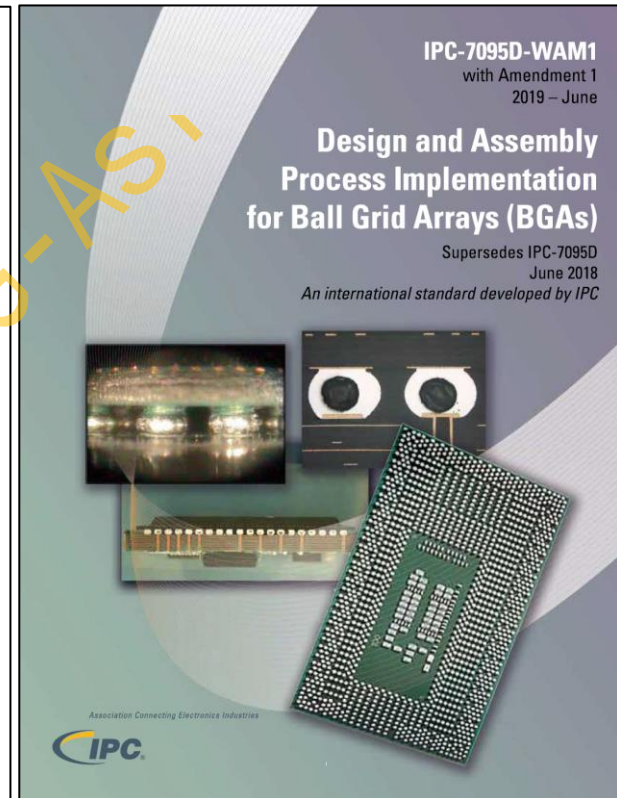
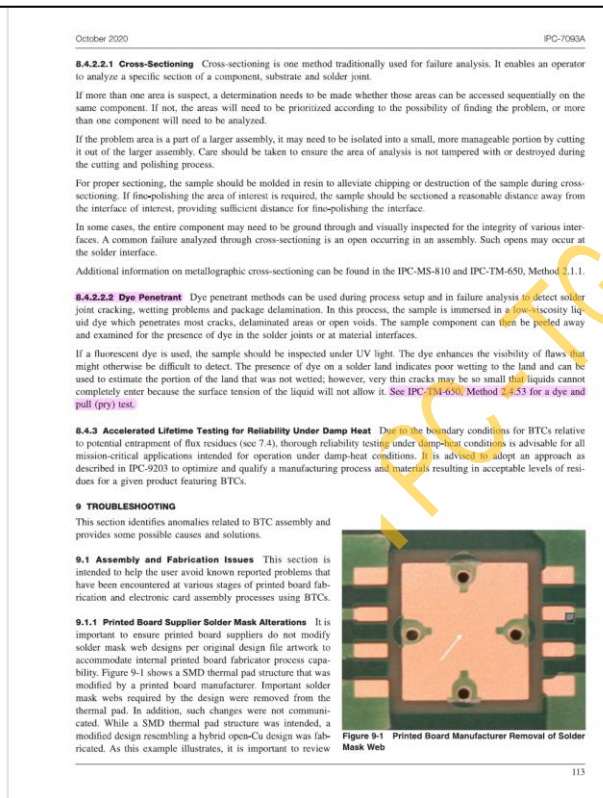
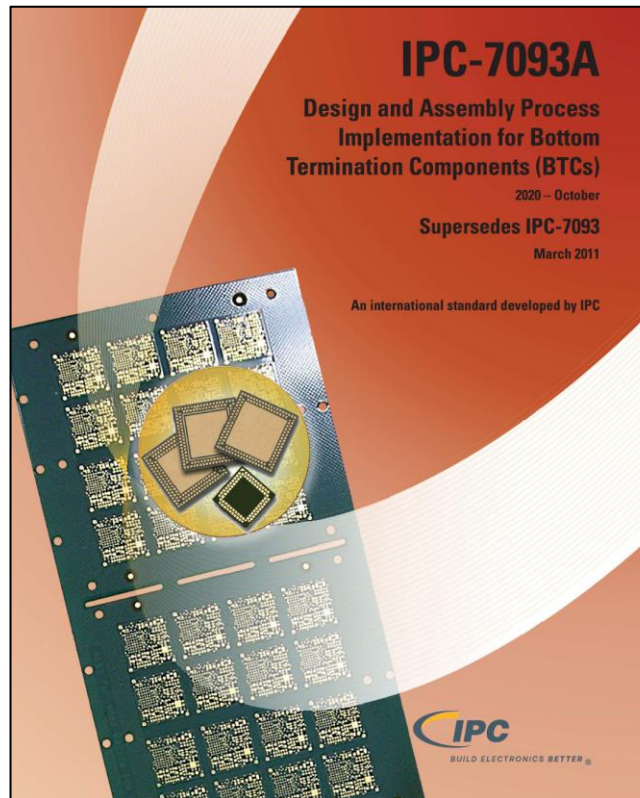
September 2020

IPC-A-610H

染色与拉力的应用(7093A: BTC, 7095D: BGA)

IPC-7093A: 8.4.2.2.2 染色渗透


IPC-7095D: 7.3.8.2 染色渗透



“原红墨水染色(Dye)和撬动(Pry)”的风险及演进

Dell Dye and Pry Failure Analysis Procedure, Number: REL0164, Revision: A00

Dell Dye and Pry Failure Analysis Procedure, Number: REL0164, Revision: A02



Dell Controlled Print

Dye and Pry Failure Analysis Procedure

Number: REL0164
Revision: A00

Engineers/Owners: Dell Reliability Organization & Component/Materials Failure Analysis Lab

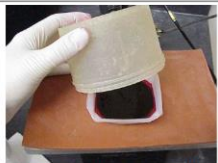
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Reliability Failure Analysis Procedure - Dye and Pry Rev: A00 3 of 4


- Following removal from the oven, allow the part to cool.
- The component is then mechanically removed. It can be pried off with a chisel but this may damage bumps on the outer one or two rows. The board can also be repeatedly flexed until the device "pops" off.
- After the component is removed, the board and part are to be examined. Fractured wetting pad surfaces on either the board or the component will be dyed red.
- Take photos of dyed regions and plot results in a matrix chart.



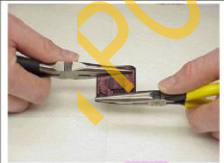
Immerse in dye and place in vacuum.



Ensure dye is completely dry.




Remove component by prying or,



remove component by twisting.

Photos from Universal Instruments.

DELL Confidential 05/18/2004



Dell Controlled Print

Dye and Pry Failure Analysis Procedure

Number: REL 0164
Revision: A02

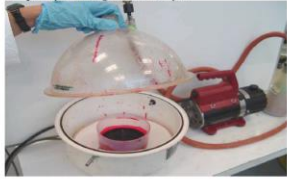
Engineers/Owners: Dell Reliability Organization & Component Materials Analysis Lab

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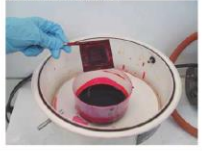
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Picture 5 showing the Dye Vacuum Station (old Bucher epoxy mounting station). Sample is completely submerged into the dye.



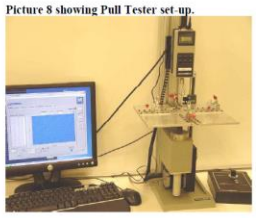
Picture 6 showing sample being pulled from dye (normally this is done in the Fumehood).



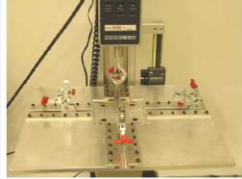
Picture 7 showing sample with tee nut bonding adhesive and hook for Pull test.



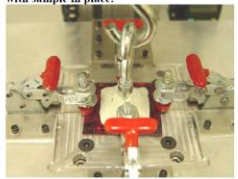
Picture 8 showing Pull Tester set-up.



Picture 9 showing Pull Tester stage and clamps.



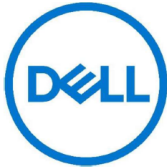
Picture 10 showing close-up of stage clamps with sample in place.



“原红墨水染色(Dye)和撬动(Pry)”的风险及演进



Dell Dye and Pry Failure Analysis Procedure, Number: REL0164, Revision: A06




Infrastructure Solutions Group

Dye and Pry Procedure


Number: REL0164
Revision: A06

Owner: Global Reliability Engineering

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Doc: REL0164

Rev: A06

Dye and Pry Procedure

Update: 2022/03/21

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Revision History

Date	PCO	Revision	Explanation of Changes	Change Originator	Approvals
20 May 04	PCO00872	A00	Initial Release	Dan Stein	Ed Tinsley
16 Mar 15	PCO29017	A01	Update Requirements	Dan Stein	N/A
16 Mar 15	PCO29018	A02	Update Requirements	Dan Stein	N/A
20 Mar 15	PCO29046	A03	Format change	Dan Stein	Tom Homorodi
29 Sep 17	PCO36885	A04	Update Requirements	Dan Stein	Tom Homorodi
9 Oct 19	PCO43268	A05	Format Update	Dan Stein	Tom Homorodi
21 Mar 22	PCO48637	A06	Format update and expanded A/R Criteria	Dan Stein	Tom Homorodi

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IPC-TM-650 2.4.53 染色和拉力测试方法



文件所属：底部端子任务组

Association Connecting Electronics Industries



3000 Lakeside Drive, Suite 105N
Barrackburn, IL 60015-1249

IPC-TM-650
TEST METHODS MANUAL

1 Scope This test method details the dye and pull procedure (formerly known as dye and pry) utilizing dye penetrant analysis of surface-mount technology (SMT) components to confirm assembly process parameters and solder joint quality/integrity.

This Test Method is for observation only, to determine the existence of dye indications.

2 Applicable Documents

IPC-7095 Design and Assembly Process Implementation for Ball Grid Arrays (BGAs)

3 Test Specimens The specimen is a SMT part soldered to a board. Typically, this method is used on ball grid arrays (BGAs) to evaluate their solder joint quality/integrity; however, it also can be used on other SMT parts, such as bottom termination components (BTCs) and connectors.

4 Apparatus or Material

4.1 Recommended dye: Red Steel Dykem® or equivalent

4.1.1 Oil-based dyes are not recommended for this procedure.

4.2 Vacuum pump and chamber (typically a mechanical pump and bell jar)

4.2.1 Recommend metallurgical epoxy vacuum chamber with vacuum gauge

4.3 Stereo microscope with digital camera

4.4 Baking oven capable of 100 °C

4.5 Cutting tool to section-out desired components from the board without exerting excessive stress on the solder joints

4.5.1 Diamond sectioning saw recommended

4.6 JB Weld or equivalent structural adhesive strong enough to bond the tee nut to the part package surface and withstand the pull force

Number 2.4.53	
Subject Dye and Pull Test Method (Formerly Known as Dye and Pry)	
Date 8/2017	Revision
Originating Task Group Bottom Termination Components (5-22k)	

4.7 Tool to separate the component from the board

4.8 Compressed or canned air

4.9 Appropriate solvent (or solvent agreed upon between the lab and the customer) for removal of flux residues remaining on the board

4.10 General/assorted lab equipment (e.g., tongs, glass beaker, cut-down plastic beaker, funnel, etc.)

4.11 Recommended safety equipment (e.g., fume hood, gloves, eye protection, etc.)

4.12 Tee nuts appropriate to the size of the part

4.13 Sand paper (320 grit)

5 Procedure

5.1 Identify components to be dye and pull evaluated (consult test plan).

5.2 Perform an initial visual examination of the selected SMT part.

5.2.1 The initial visual examination is used to detect signs of mechanical damage/stress. If flux is present, examine for fractured/broken-up or disturbed flux around the SMT solder joints (see Figure 1 and Figure 2).

5.2.2 If the SMT part required the use of **corner-applied adhesive** and the adhesive is visible, examine and document it per customer requirements to determine if dye and pull testing is applicable. See IPC-7095 for additional guidance on the **proper use of corner-applied adhesive**.

5.3 If the part has a heatsink, package metal heat spreader or any other assembly that is attached, proceed as follows to avoid inducing any mechanical stress into the solder joint.

5.3.1 Remove the heatsink. If there is any concern with the proper method to remove an attached heatsink, it is highly recommended that it be left in place until after the dye-drying step (5.11).

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Page 1 of 11

IPC-TM-650		
Number 2.4.53	Subject Dye and Pull Test Method (Formerly Known as Dye and Pry)	Date 8/2017
Revision		

Figure 10 Example of Pull Method to Remove the BGA From the Board

Note: These photographs are for reference only and should not be construed as implying that a measurement is being made in accord with this method.

Figure 11 Example of a Pull Tester Stage and Clamps

Note: These photographs are for reference only and should not be construed as implying that a measurement is being made in accord with this method.

Figure 12 Typical Pull-Test Fixture With Stage Clamps

Note: These photographs are for reference only and should not be construed as implying that a measurement is being made in accord with this method.

Figure 13 Example Showing Ball Grid Array (BGA) Part (Top) and Remaining Board (Bottom)

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1. 范围

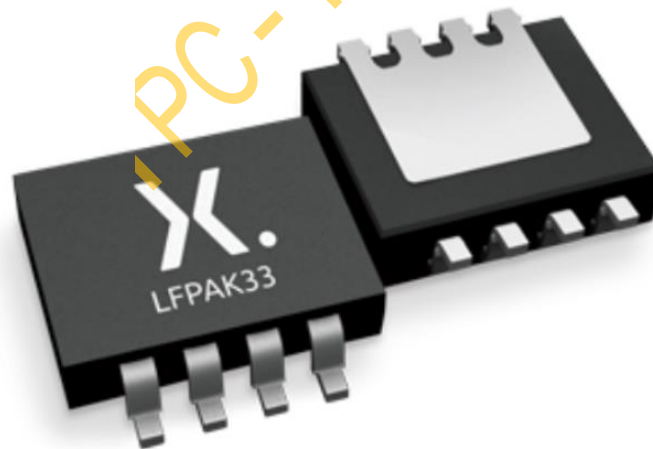
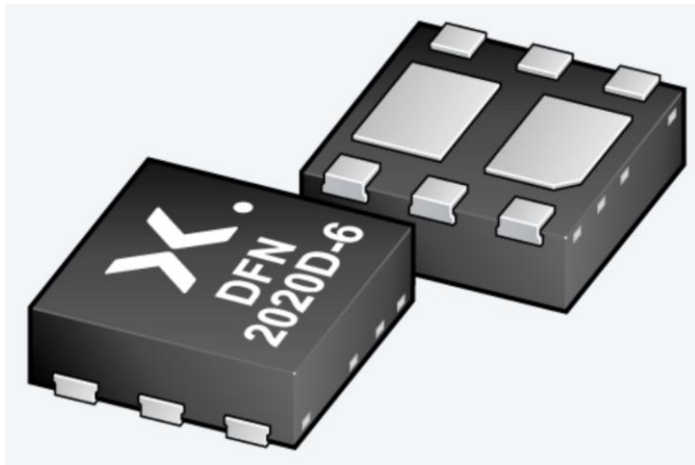
- > 利用表面贴装技术(SMT)组件的染色渗透分析来详细介绍染色和拉拔程序（以前称为染色和撬动Pry），来确认组装工艺参数和焊点质量(solder joint quality)/完整性(integrity)。
- > 仅用于观察，来确定是否有染料的存在。

2. 适用文件

- > IPC-7095(D) BGA设计与组装工艺的实施 (7.3.8.2)
- > IPC-7093(A) 底部端子元器件(BTC)设计和组装工艺的实施 (8.4.2.2.2)

3. 测试样品

- > 本样品是焊接到板上的 SMT 零件。通常，此方法用于球栅阵列 (BGA)，以评估其焊点质量/完整性；
- > 它也可用于其他 SMT 零件，例如底部端子组件 (BTC) 和连接器。



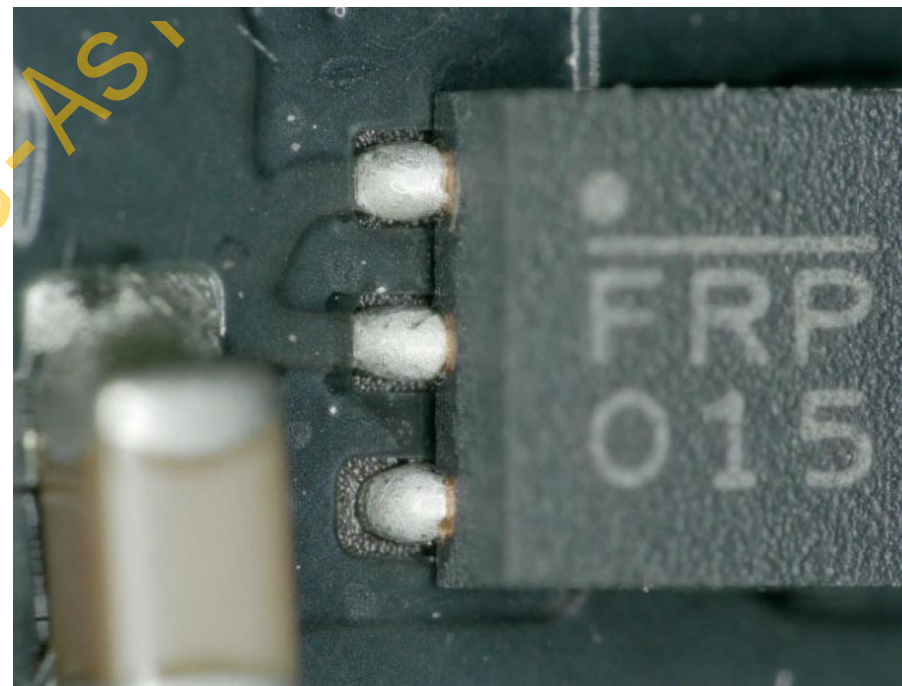
4. 仪器或材料

- > 立体显微镜(染色前后的目视检查，含底部填充)
- > 切割工具(推荐金刚石切片锯Diamond sectioning saw，参考IPC-MS-810 3.2，为拉力夹持与降低应力切割距离样品至少19~38mm)
- > 滤油滤水后的压缩空气(清洁与去除助焊剂去除剂)
- > 浸泡与喷洒助焊剂去除剂
- > 推荐非油基/新鲜fresh的Red Steel Dykem染料
- > 夹持工具，玻璃烧杯；通风橱，手套，护目镜等安全配套
- > 带真空计的真空泵/腔室/100°C的烤箱
- > 320粒度砂纸打磨零件顶面与螺母/粘合剂

> 拉力机

4. 仪器或材料

> 立体显微镜(染色前后的目视检查，含底部填充)



4. 仪器或材料

> 推荐新鲜的Red Steel Dykem染料

- > 提供防止眩光和眼睛疲劳的均匀深色。
- > 可实现锐利、清晰且精确的印刷。
- > 形成不会破裂或碎裂的薄膜，并且几乎不会增加工作表面的厚度。
- > 几分钟内即干(<2 mins)。
- > 揭露各种表面的缺陷和针孔。
- > 检测焊点中的裂纹。
- > 提供多种包装尺寸。
- > 不含任何可报告含量的二甲苯。



ITW DYKEM

Technical Data Sheet

Steel Red Layout Fluids

FEATURES

- Provides a uniform deep color that prevents glare and eye strain.
- Allows for sharp, clear, and precise scribes.
- Provides a thin film without cracking or chipping and adds practically no thickness to work surface.
- Dries within minutes.
- Reveals defects and pinholes in a variety of surfaces.
- Great for inspection of gear tooth contact patterns.
- Detects cracks in solder joints.
- Available in multiple package sizes.
- Do not contain any reportable amounts of Xylene.

MATERIALS COMPATIBILITY

- Safe on most surfaces.
- Removable with Dykem® Remover & Cleaner.
- Surface tests should be run to determine compatibility prior to use.

HEALTH AND SAFETY

- Flammable liquid and vapor. Keep away from heat, sparks and flame. Use only with adequate ventilation. Avoid contact with skin and eyes.
- Refer to MSDS (Material Safety Data Sheet) for complete information on health and safety. Visit our website at www.dykem.com to obtain MSDS.

DIRECTIONS FOR USE

- Apply to a surface that is clean, dry and free of oil and grease.
- Apply a thin film to surface.

AVAILABLE IN:

Part #:

16 oz. Aerosol	80096
2 oz. Felt Tip Applicator	80296
4 oz. Brush-In-Cap	80396
8 oz. Brush-In-Cap	80496
1 Quart	80696
1 Gallon	80796
5 Gallon Pail	80896

PHYSICAL PROPERTIES

Appearance:	Red
Odor:	Alcohol
Specific gravity:	<1
VOC level:	92% - 94% by weight
Flash point:	53°F
Dry Time*:	< 2 minutes

* Note: Exact drying time may vary depending on film thickness.

4. 仪器或材料

> 砂纸 (参考已被取消的IPC-TM-650 2.1.1.2A)

IPC-TM-650		
Number 2.1.1.2	Subject Microsectioning—Semi or Automatic Technique Microsection Equipment (Alternate)	Date 05/04
Revision A		

5.2.2 Microetch the Specimen Swab or dip the specimen into a suitable microetching solution and rinse with running water. The recommended etching solutions and formulations are listed in IPC-MS-810. The etch time will vary with the type of etchant chosen to microetch the sample.

5.2.3 Evaluation Evaluate the average thickness of the plated metals and determine PTH quality per the customer's specifications.

6 Notes

6.1 Diamond Polish The diamond polish media is preferred over alumina for PCBs being evaluated to IPC-6012 Class 2 and 3 products. Diamond media substantially reduces the risk of metal smear and rounding. Diamonds provide a sharper definition of copper surfaces to evaluate for separation of conductive surfaces.

6.2 Etchants The two most common microetchants for copper are ammonium hydroxide/hydrogen peroxide and sodium dichromate etchant. Both have benefits and drawbacks that must be considered when making a choice (see IPC-MS-810).

6.3 Abrasive Paper The abrasive grit size has different

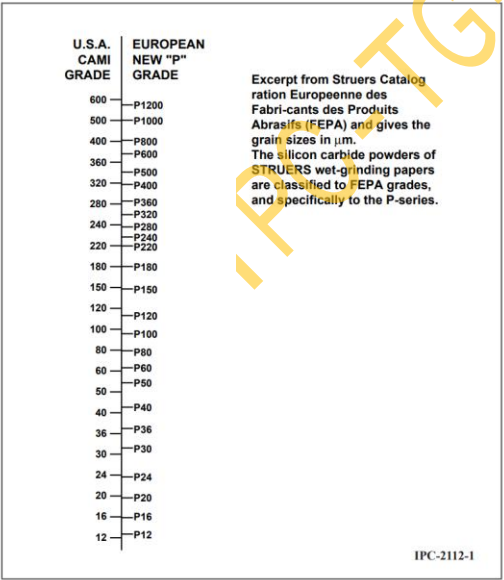
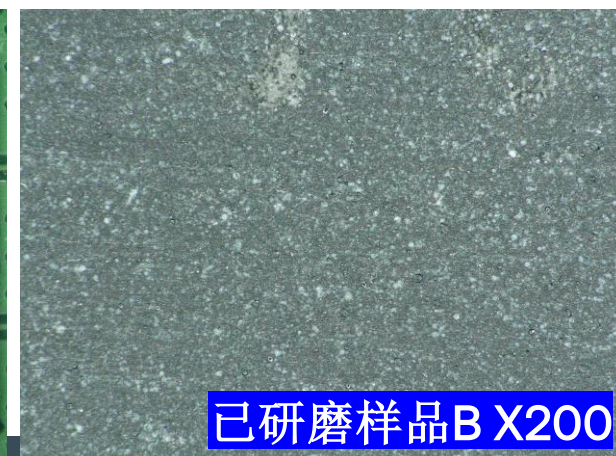
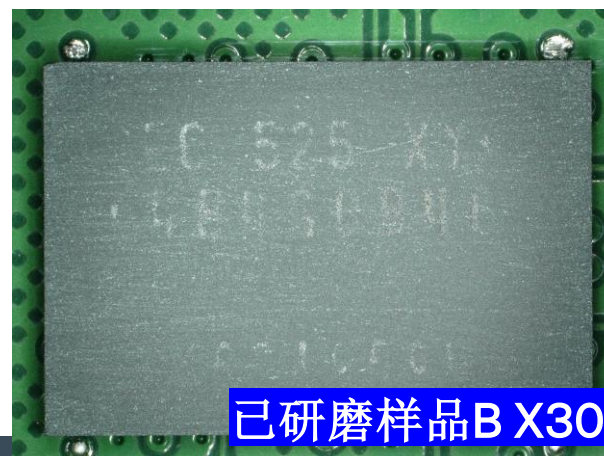
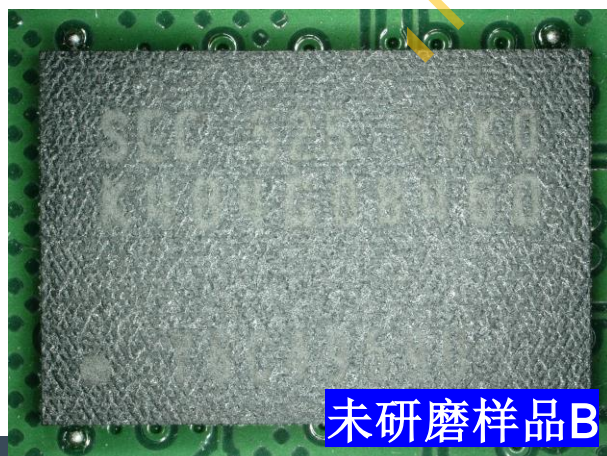
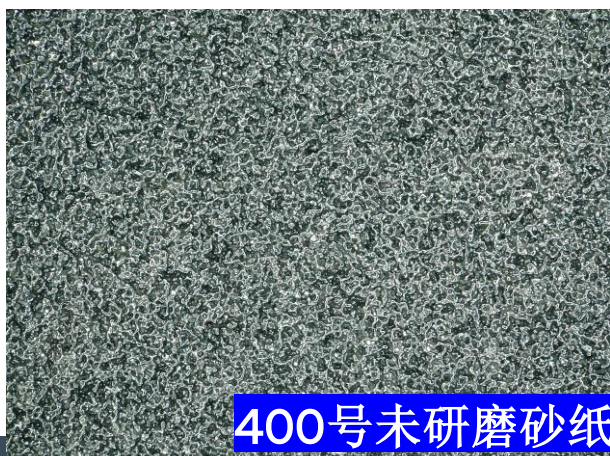
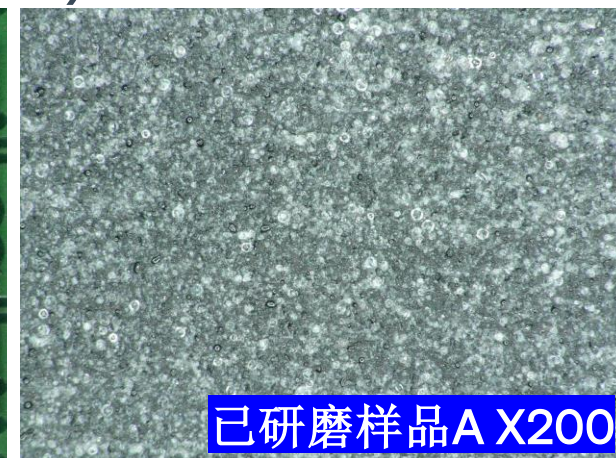
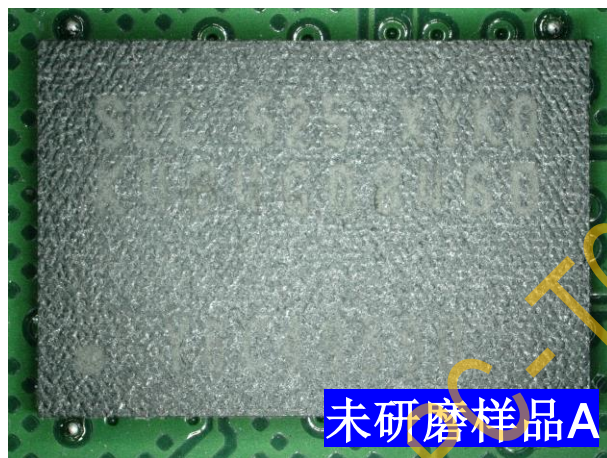
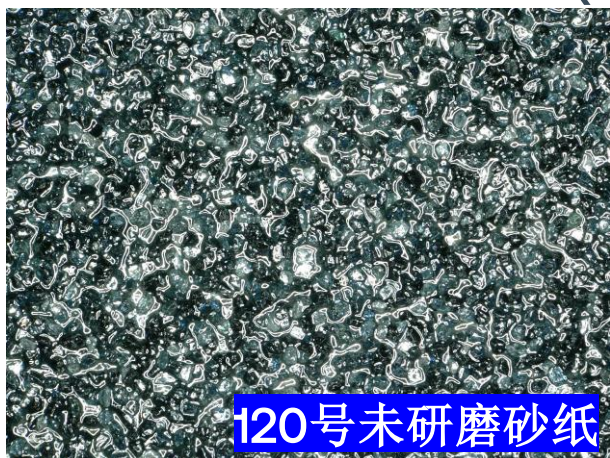


Figure 1 Abrasive paper grit size (American vs. European)

FEPA(欧美)		ANSI/ CAMI(美国)	
粒度号	尺寸 (微米)	粒度号	尺寸(微米)
P120	127.0	120	116.0
P180	78.0	180	78.0
P240	58.5	220	66.0
P280	52.2	240	51.8
P320	46.2		
P360	40.5	280	42.3
P400	35.0	320	34.3
P500	30.2	360	27.3
P600	25.8	400	22.1
P800	21.8		
P1000	18.3	500	18.2
P1200	15.3	600	14.5
P1500	12.6	800	12.2
P2000	10.3	1000	9.2
P2400	8.4	1200	6.5
P4000	5.0		

4. 仪器或材料

> 研磨效果分组(粗糙度比对: 上排120号/下排400号砂纸)



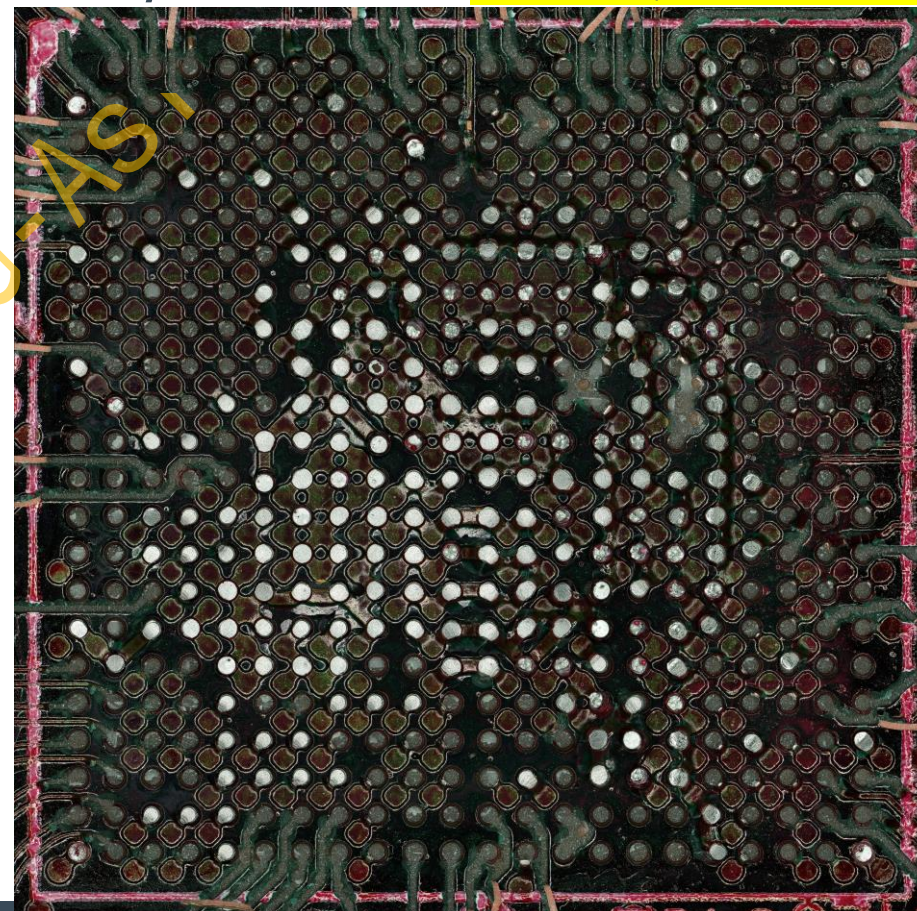
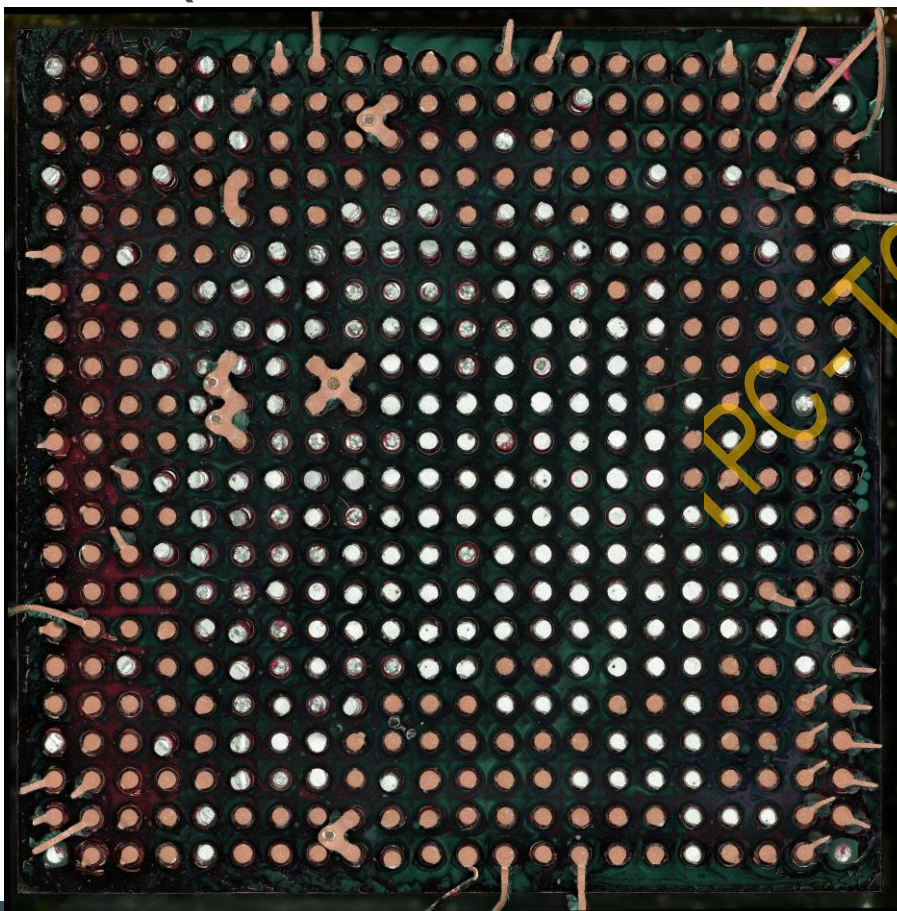
4. 仪器或材料

> 粘合剂(标准未定义: Pertex mounting medium)

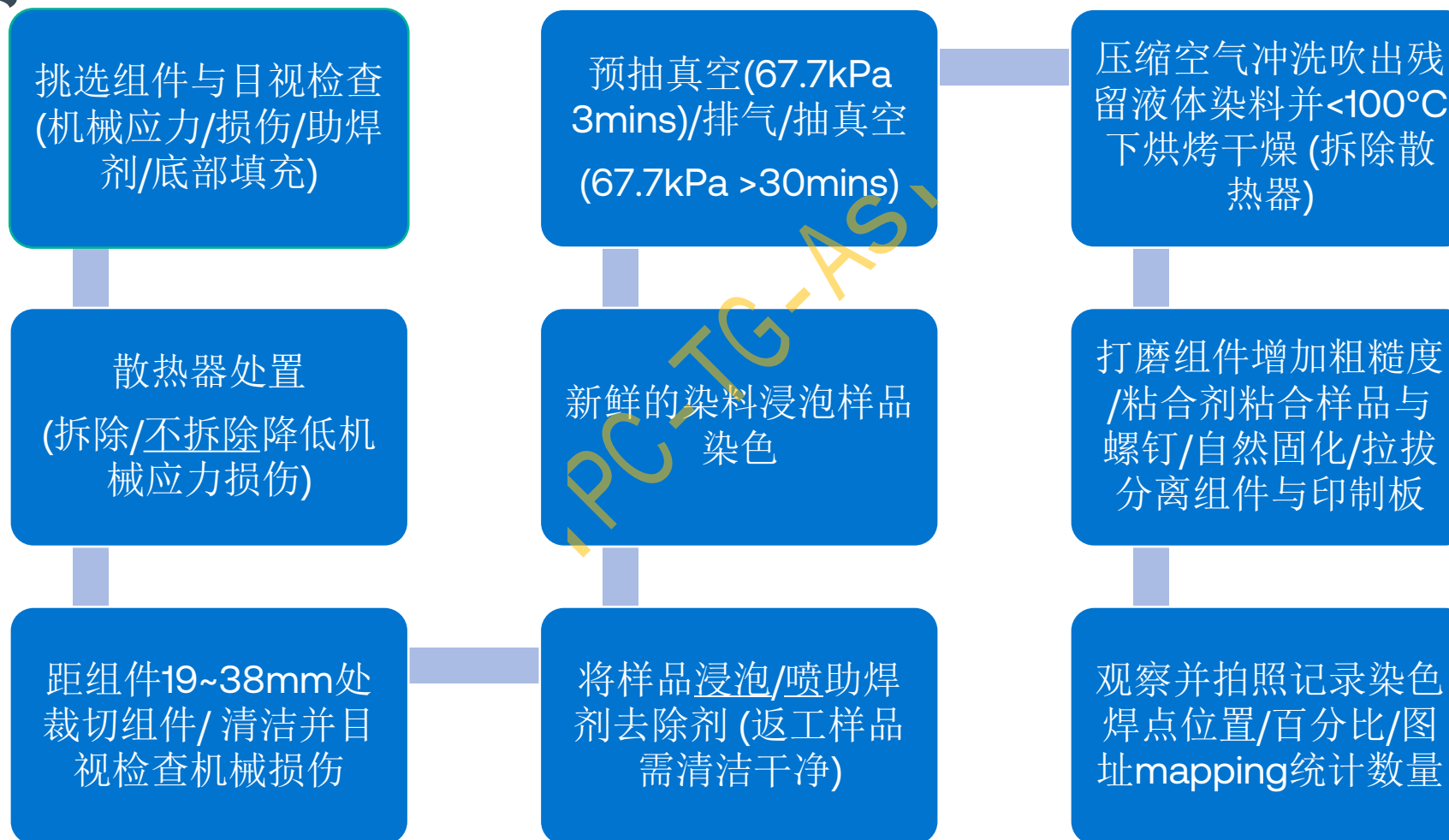


4. 仪器或材料

> 立体显微镜(染色后的目视检查：左组件/右板子，高倍率拼接全图)



5. 程序



6. 注释/图示

- > 本节中的图示仅供参考。它们不为执行本测试方法描述正确或不正确的方法。

IPC-TG-AS

测试报告

- > 包括以下内容（或实验室与客户之间达成的协议）
 - > （染色前）初始目视观察
 - > 染色界面分离位置
 - > 如果需要，染色迹象indication数量/百分比（在实验室和客户之间确定的可接受标准）
 - > 绘制所有分离位置
- > 本测试方法没有定义染色可接受性标准

测试报告

> 染色界面分离位置(示意1)

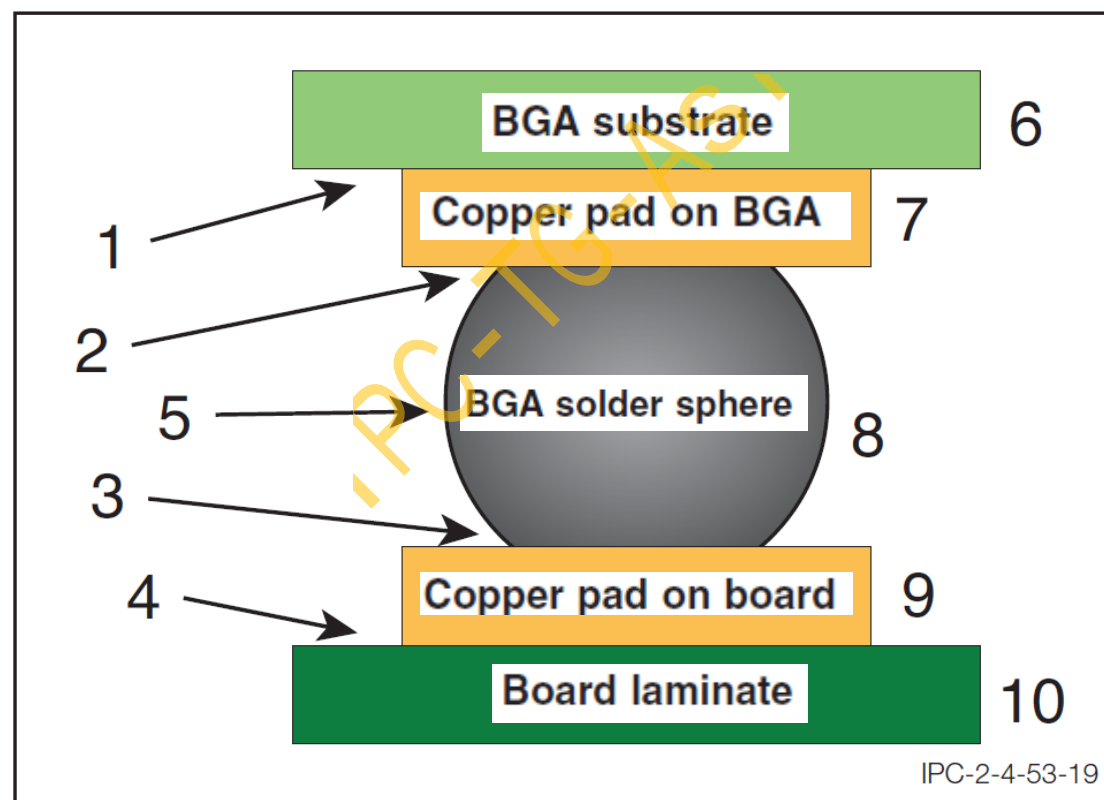
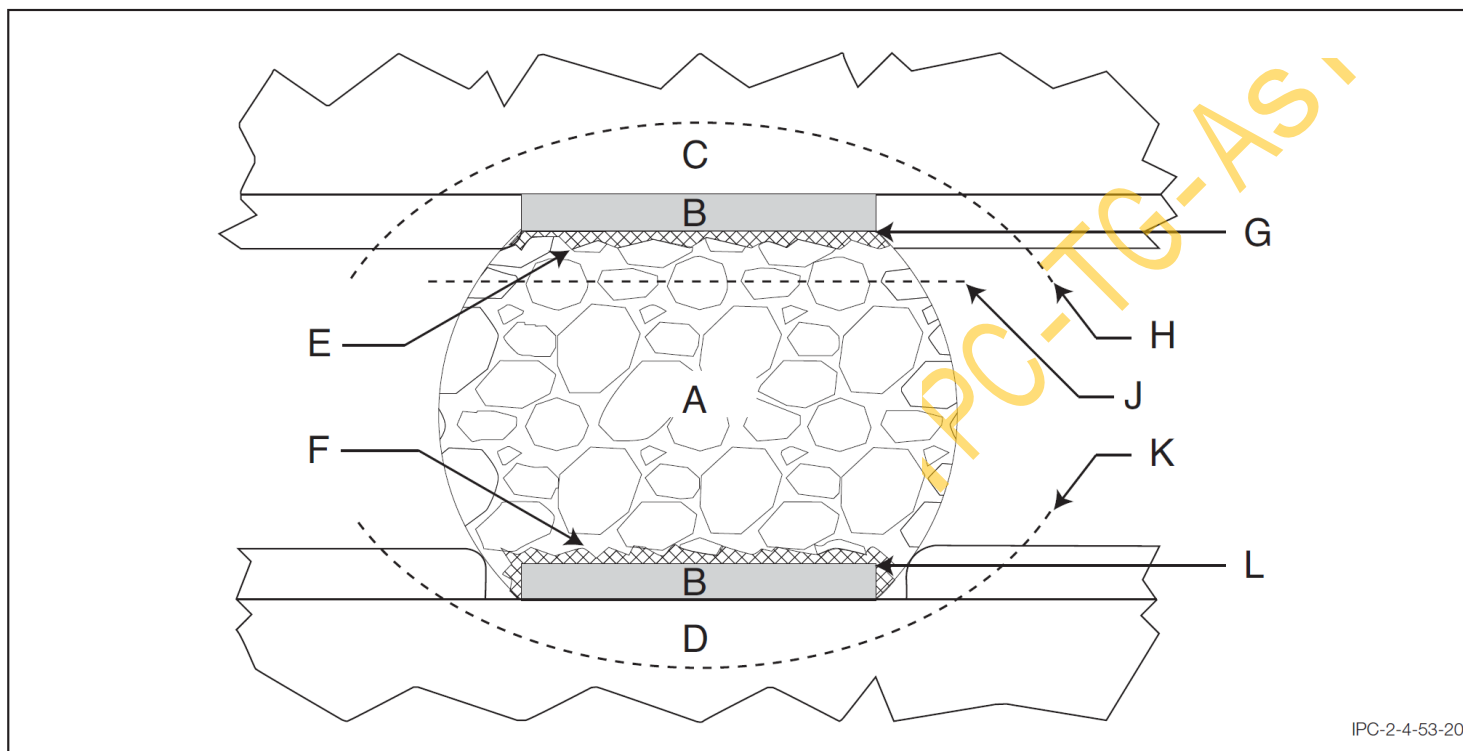


Figure 19 Example of Dye and Pull Location Type

测试报告

> 染色界面分离位置(示意2)



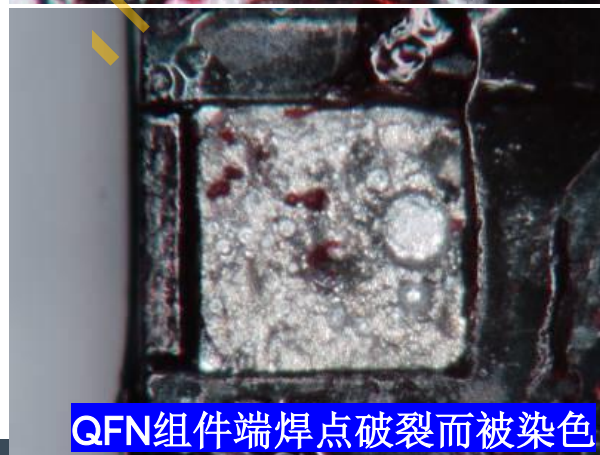
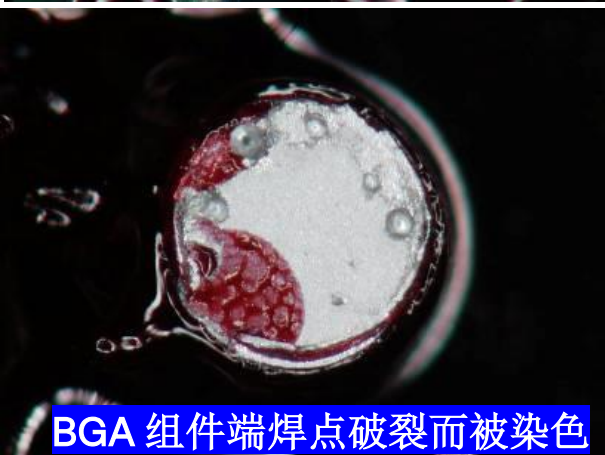
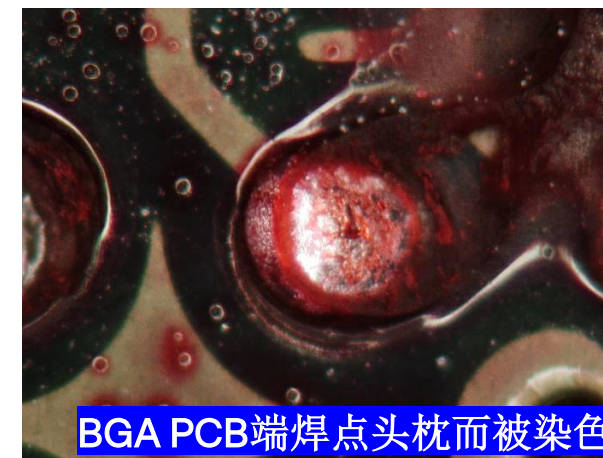
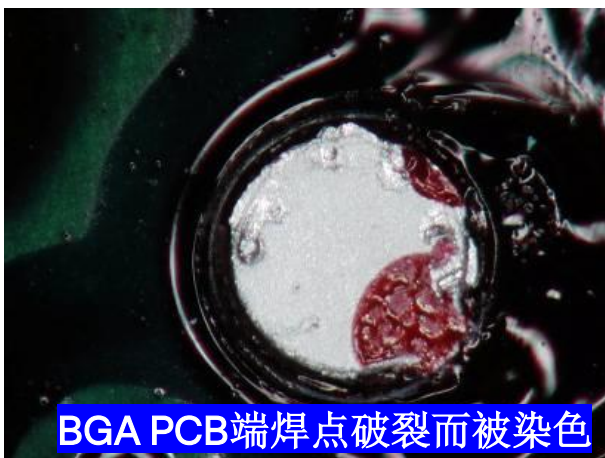
- A. Solder ball
- B. Metal pad
- C. Package substrate
- D. Board
- E. Fracture at package side intermetallic compound (IMC)/solder interface
- F. Fracture at board side IMC/solder interface
- G. Fracture at package metal/IMC interface
- H. Package pad lift/crater
- J. Fracture within bulk solder
- K. Board pad lift/crater
- L. Fracture at board metal/IMC interface

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Figure 20 Typical Dye and Pull Separation Locations

测试报告

> 染色迹象indication



测试报告

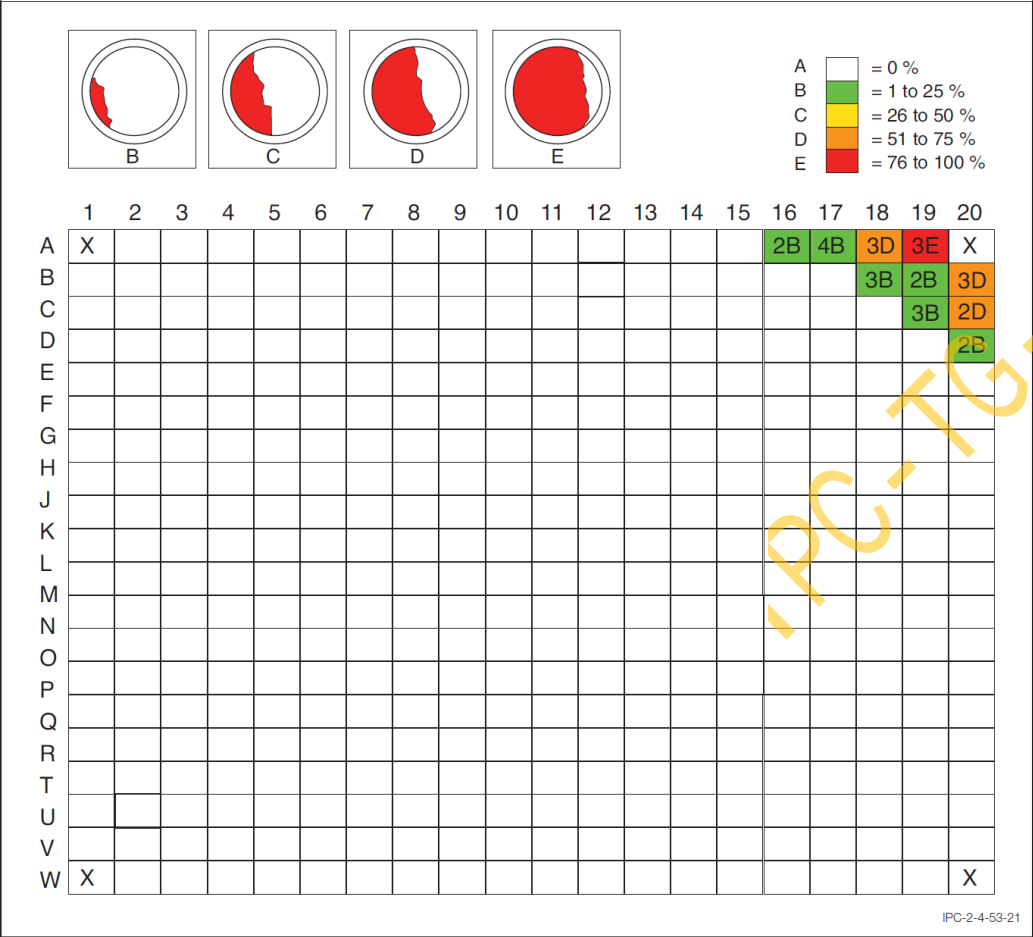


Figure 21 Example of Dye and Pull Location Type Coverage Mapping

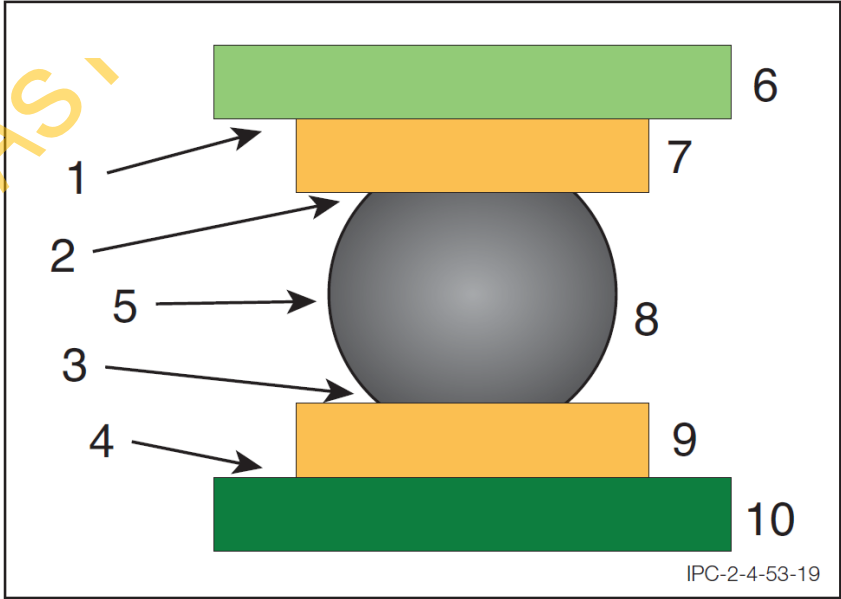
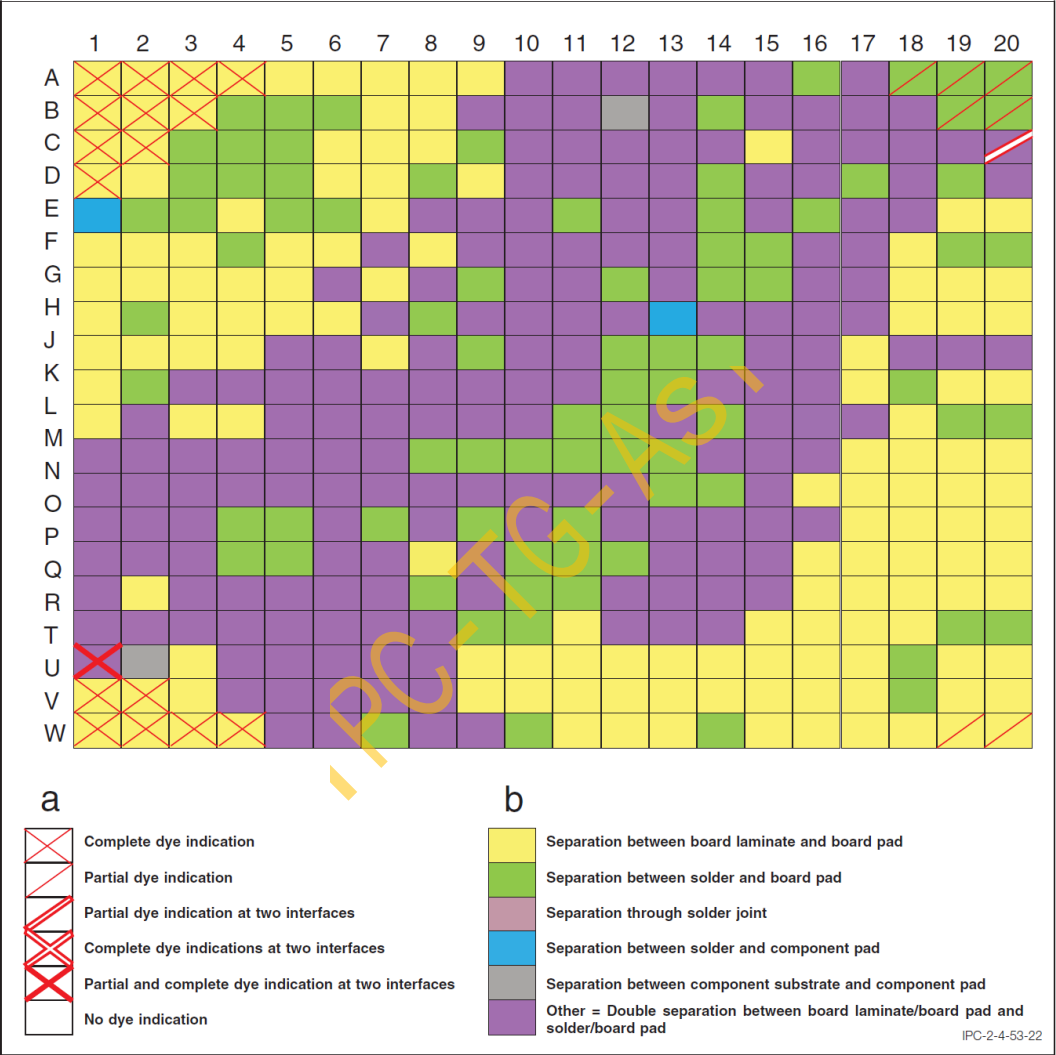


Figure 19 Example of Dye and Pull Location Type

颜色表染色迹象百分比/数字1~5表分离位置/ I/O地图mapping数量分布(示意1)

测试报告



符号染色迹象百分比/颜色表分离位置/I/O地图mapping数量分布(示意2)

Dell染色与拉拔判定参考

Dell Dye and Pry Failure Analysis Procedure, Number: REL0164, Revision: A06

Doc: REL0164	Dye and Pry Procedure	Update: 2022/03/21
Rev: A06		Page: 5 / 32

4.3 Test Requirements and Conditions

- Unless otherwise stated by Dell Engineering, the samples selected for the D&P Test shall be determined in the Product Qualification Plan.
- If the D&P Test is conducted outside Dell, all test reports shall be submitted to Dell Reliability Engineering and the CMA (Component Material Analysis) Lab for review and approval.

5 Pass/Fail Criteria

If Edge Glue (corner adhesive) is used, it shall meet Dell criteria as listed in Appendix A. If the criteria are not met, the sample is considered invalid for any D&P testing.

5.1 On Pre-Reliability tested product

- No dye indications at any of the Type locations are acceptable.

5.2 On Post-Reliability tested product (post Shipping/Drop Test, Temperature Cycle, Shock & Vibration, etc.)

- No Dye Indication > 80% is allowed for Type 2 (top of BGA solder ball to IC pad), Type 3 (bottom of BGA solder ball to PWB pad) and Type 5 locations (within the bulk solder).
- No Dye Indications > 25% are allowed for Type 1 or Type 4 locations (IC carrier laminate or the main PWB laminate fractures). In addition, no Dye Indications on exposed PWB glass bundles are allowed (regardless of the dye coverage percentage).
- Exception: for "via-in-pad" designs, dye is allowed on the laminate surface (under the pad), if the dye has not entered the inner-via laminate area or is found on the separated via-barrel wall. However, no Dye Indications are allowed on exposed PWB glass bundles.
- Allowances for non-acceptable dye indications on mechanical (non-electrical) BGA corner locations or multiple use locations (Grounds, Powers) may be made by the Dell Team (SQE Engineering, Reliability Engineering, CMA Lab, etc.).
- Refer to Appendix E for detailed drawings of the PASS/FAIL criteria.

6 Reporting

Provide evidence that all requirements are met with pictures, completed Appendix Maps, etc. PASS/FAIL as per Dell D&P criteria is an acceptable summary statement but **SHALL** be supported with data/evidence.

6.1 All D&P Reports shall state, within the report, that the Reference documents listed below were followed:

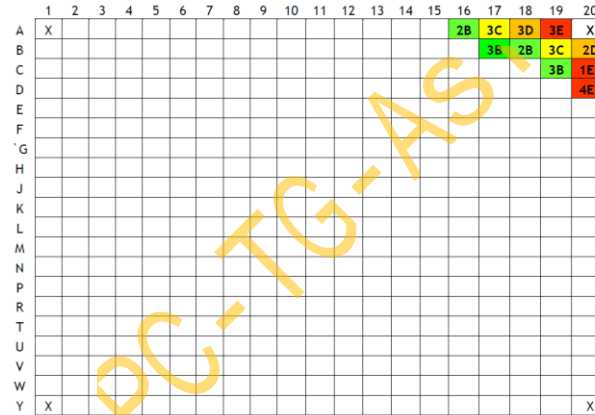
- IPC TM-650 2.4.53 Dye and Pull Test (formally known as Dye and Pry), for the proper test method in performing the D&P.
- Dell REL0164 Dye and Pry Failure Analysis Procedure, for the proper reporting requirements.

6.2 Required board and D&P part documentation (Reference Appendix D for Examples).

- Title page shall state what test the board has completed (post TC, post 5&V, etc.).
- Board photo identification requirements.
 - Photos showing the complete side 1 (component side). A photo showing side 2 (backside) of the board under test is optional.
 - Highlight location of the selected D&P part on the board.
 - Serial and piece part identification (ppid) number.
 - Raw board supplier.
 - Raw board date code.

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8 Appendix B - D&P Location Map showing the Dye Indication and Percentage



Guide to reading the Matrix,

The following location are considered Acceptable for a post Reliability Test, (less than 80% dye indications):

- A16 is a Pass (Type 2B with less than 25% dye indication).
- A17 is a Pass, (Type 3C with less than 50% dye indication).
- B17 is a Pass (Type 3B with less than 25% dye indication).
- B18 is a Pass (Type 2B with less than 25% dye indication).
- B19 is a Pass (Type 3C with less than 50% dye indication).
- C19 is a Pass (Type 3B with less than 25% dye indication).
- A18 is a Pass (Type 3D with less than 80% dye indication).
- B20 is a Pass (Type 2D with less than 80% dye indication).

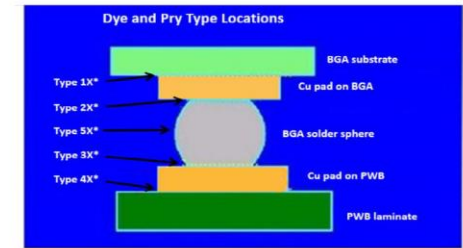
The following location are considered Rejectable for a post Reliability Test, (more than 80% dye coverage or dye on exposed glass bundles for Type 1 or 4 laminate locations)

- A19 is a FAIL (Type 3E with greater than 80% dye indication coverage).
- C20 is a FAIL (Type 1E1 with >25% dye coverage).
- D20 is a FAIL (Type 4E2 with dye on glass bundles).

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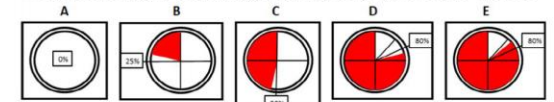
9 Appendix C - Separation Types with Dye Coverage Percentages

- D&P Separation Types with Dye Coverage Percentage



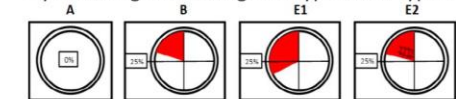
* The "X" refers to the dye coverage percentage below

Dye Coverage Percentage for Type 2, Type 3 and Type 5



- A WHITE = coverage percentage = 0%
- B GREEN = coverage percentage = 1 - 25%
- C YELLOW = coverage percentage = 26 - 50%
- D ORANGE = coverage percentage = 51 - 80%
- E RED = coverage percentage = 81 - 100%

Dye Coverage Percentage for Type 1 and Type 4



- A WHITE = coverage percentage = 0%
- B GREEN = coverage percentage = 1 - 25% and No dye on exposed glass bundles
- E1 RED = coverage percentage = 26 - 100%
- E2 RED = dye on exposed glass bundles (regardless of the dye amount percentage).

IPC-9708 鉴定印制板组件焊盘坑裂的测试方法

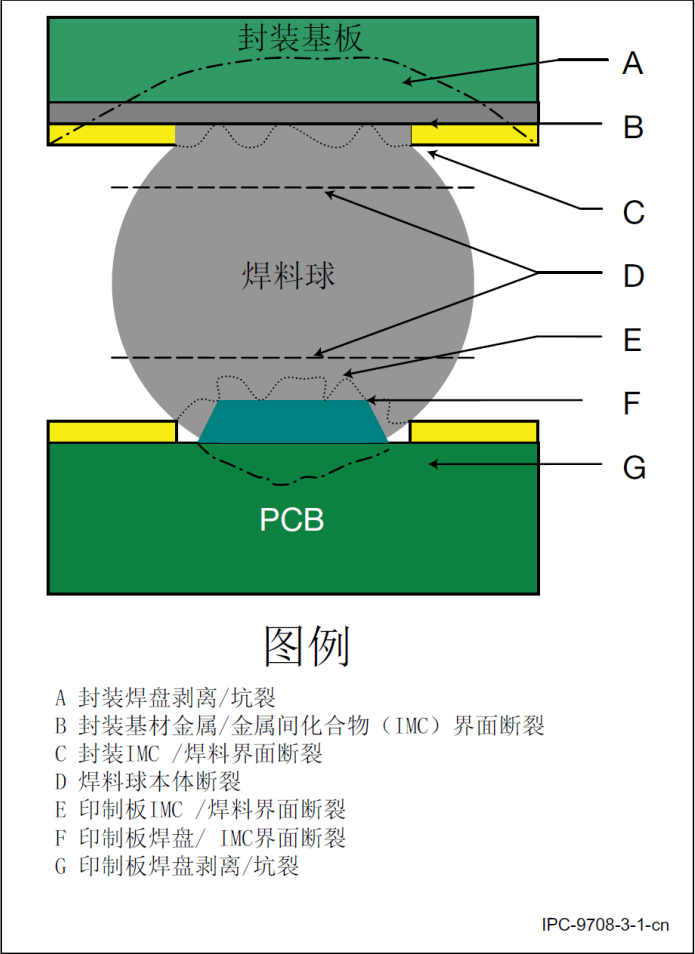
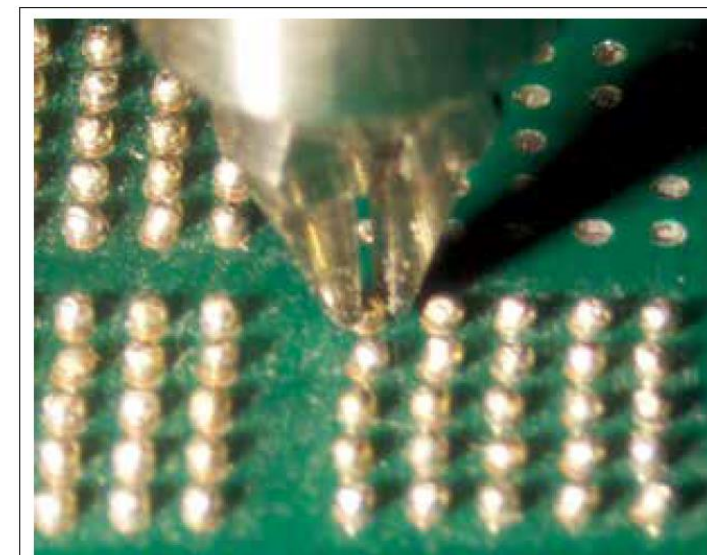
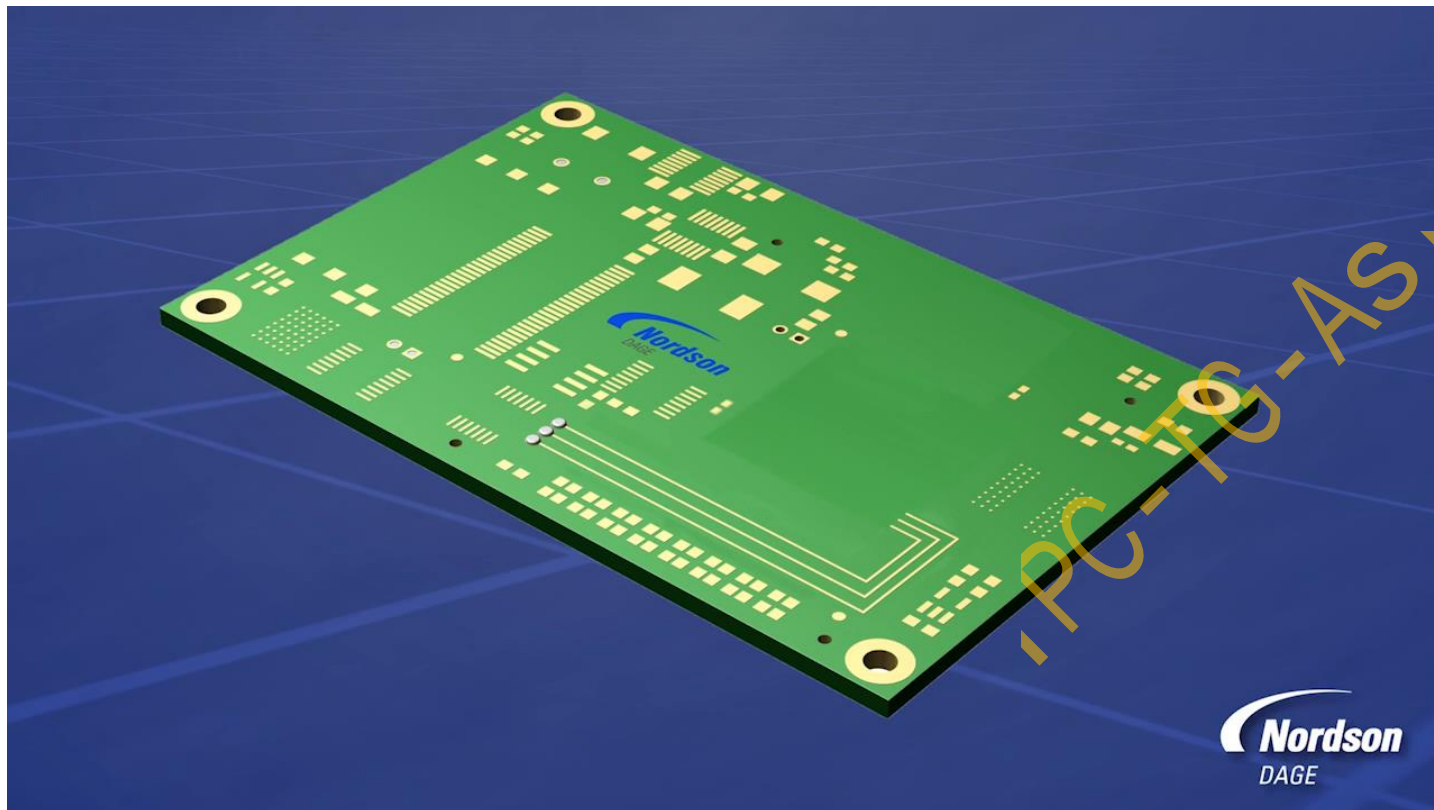


表3-1引脚拉拔、焊球拉拔、焊球剪切测试的优点和面临的挑战

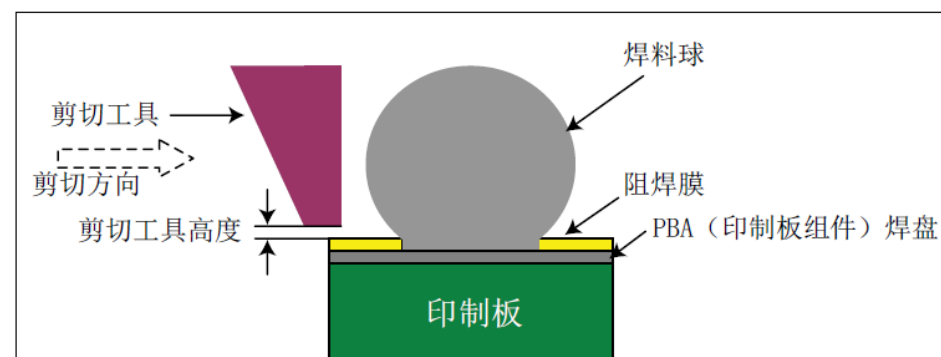
测试方法	优点	挑战
引脚拉拔测试	<ol style="list-style-type: none">1. 可用于任何几何形状的焊盘2. 不需要焊料球附着3. 对印制板材料 and 设计变量的差异化比焊球剪切测试更敏感	<ol style="list-style-type: none">1. 需要引脚被焊接到焊盘，它昂贵且耗时2. 需要印刷焊膏
焊球拉拔测试	<ol style="list-style-type: none">1. 可于BGA植球后快速测试2. 成本效应佳——不需要昂贵的引脚3. 可以产生跟引脚拉拔测试类似的失效模式	<ol style="list-style-type: none">1. 只能用于BGA几何形状的焊盘2. 需要BGA植球3. 取决于焊料球，因此，需要控制其它参数（夹紧压力、保持时间、焊球大小、焊球与焊盘尺寸的比率、焊球合金、夹爪大小等）
焊球剪切测试	<ol style="list-style-type: none">1. 可于BGA植球后快速测试2. 不需要像焊球拉拔测试那么多的控制测试参数	<ol style="list-style-type: none">1. 只能用于BGA几何形状的焊盘2. 需要BGA植球3. 剪切测试需要使用“L”形的焊球矩阵4. 对印制板材料 and 设计变量的差异化较引脚拉拔测试和焊球拉拔测试更不敏感

图3-1 发生在BGA PBA组装的失效模式分类范例

IPC-9708 鉴定印制板组件焊盘坑裂的测试方法



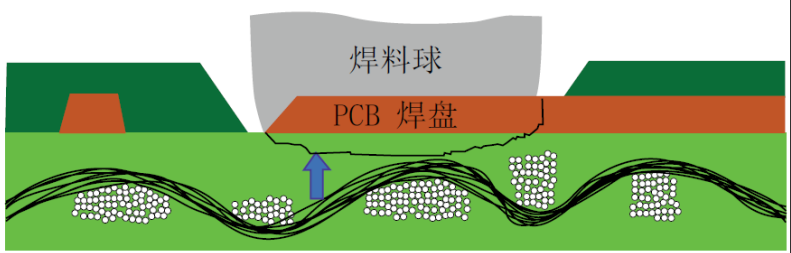
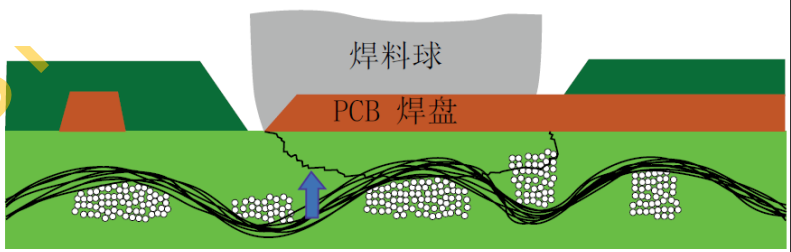
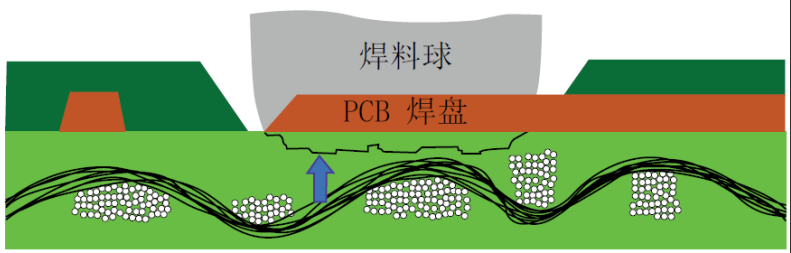
IPC-9708-3-15-cn



IPC-9708-3-16-cn

IPC-9708 鉴定印制板组件焊盘坑裂的测试方法



模式	类型	描述	示意图
4	导体开裂	印制电路板焊盘被剥离，但仍部分连接到导体。	
5	玻璃纤维暴露的坑裂	印制电路板焊盘坑裂和底层的玻璃纤维暴露。	
6	玻璃纤维没有暴露的坑裂	印制电路板焊盘的坑裂，底层树脂暴露，但没有见到玻璃纤维。	
7	通孔暴露的坑裂	印制电路板焊盘坑裂，焊盘中心的通孔暴露。这种失效模式只适用于焊盘中带镀通孔的测试焊盘。	参照表3-8
8	组合失效	可观察到模式1-7中几种失效模式同时存在。此时，应当对给定测试焊盘出现的每个失效模式都进行记录。	NA

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电子产品开发流程与德凯服务介绍




谢谢参与 IPC-TM-650 2.4.53 在线交流

2023/7/6 14:00~16:00

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