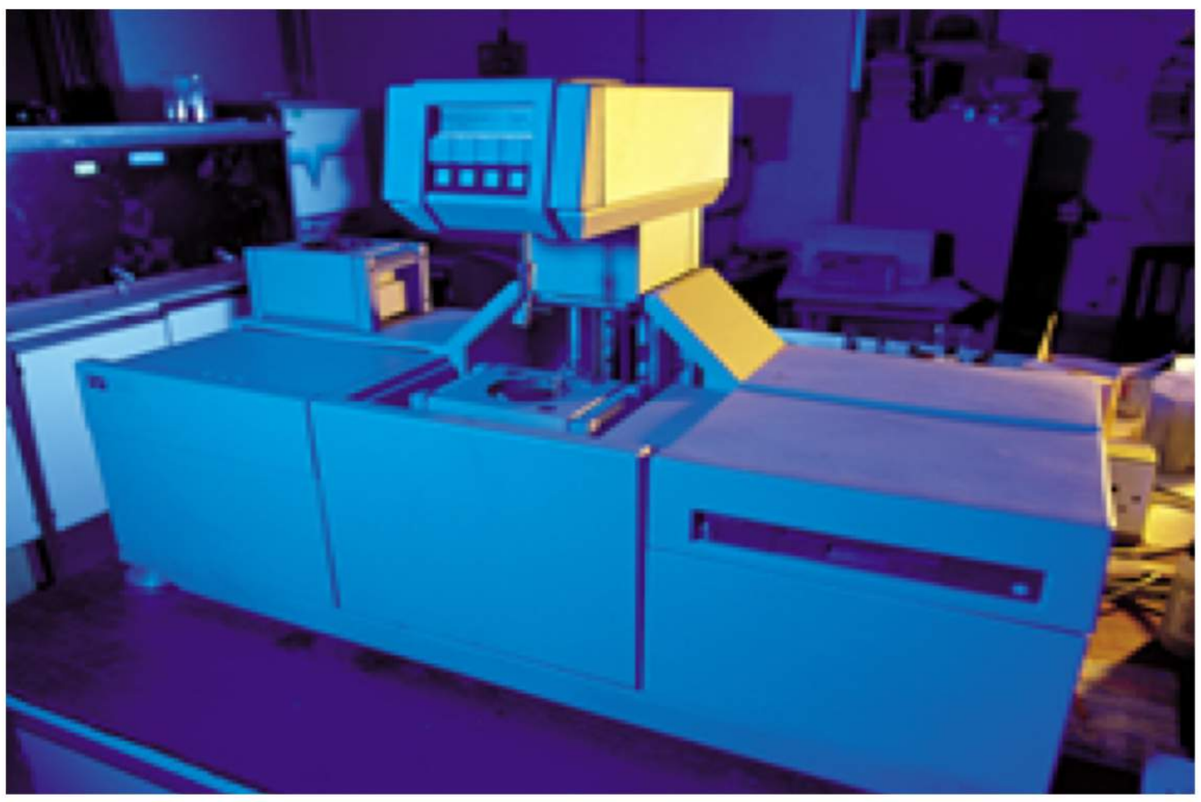
A GUIDE TO ELECTRONICS & SOLDER JOINT TESTING FOR QUALITY ASSURANCE & CONTROL PURPOSES



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ELECTRONICS TESTING

A Guide to Electronics and Solder Joint Testing for Quality Assurance & Control Purposes

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INTRODUCTION

Assuring and controlling the quality of materials, parts and finished products is a necessary and beneficial process, to ensure your products meet regulatory standards and the requirements of your customers.

Do you know which testing techniques you could or should be using on your materials, components or finished products?

When you do identify discrepancies during your testing are you clear what alternatives are available to investigate further?

This eBook was specifically designed for companies who carry out routine testing and who occasionally need additional support to identify and understand the causes and potential solutions for discrepancies.

Commonly Used Quality Assurance and Control Tests

Here are the six most commonly used tests for electronics quality assurance and control.

1. Coating and plating thickness
2. Solderability
3. X-Ray inspection
4. Cross-sectioning
5. Microscopy
6. Joint strength

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1. COATING & PLATING THICKNESS

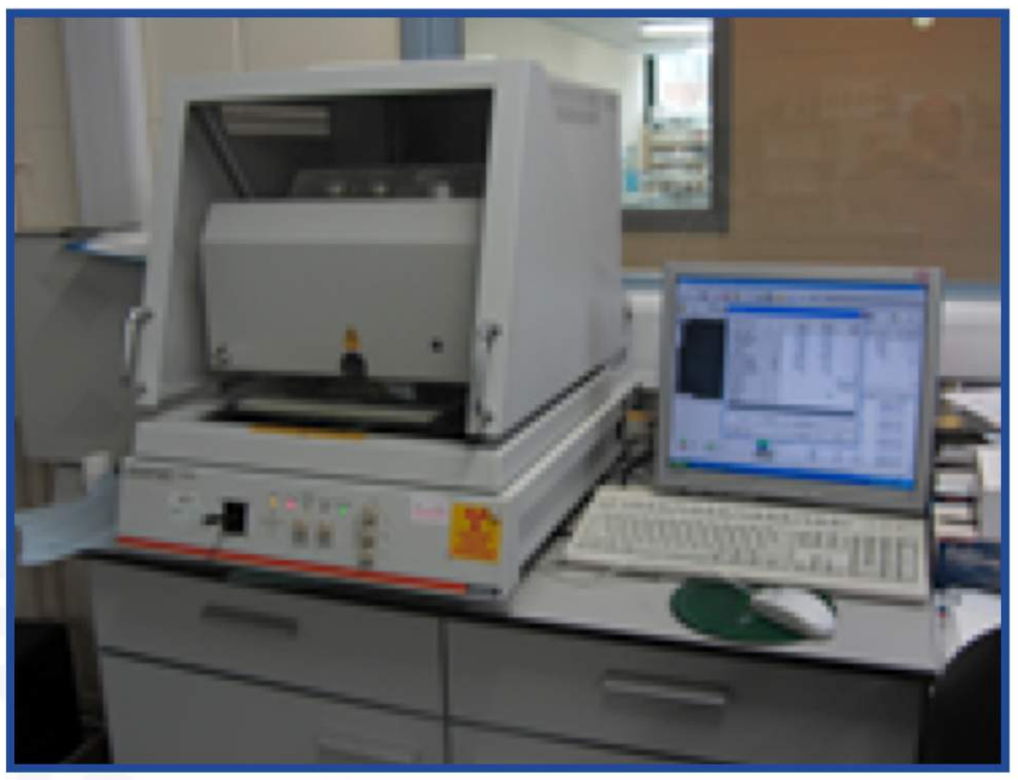
QA/QC USE:

Any variations in thickness are likely to impact the performance of the coating or plating and therefore, the product itself.

Confirming the thickness could be part of checking conformity to specification or identifying possible reasons for failure.

WHAT IS THE TECHNIQUE?

There is no one specific testing technique for inspecting coating and plating thickness, however there are some techniques that are more commonly used than others. ED-XRF is the method most commonly used for obtaining data about gold, tin, nickel or copper thicknesses.



STANDARDS AND TYPICAL APPLICATIONS

All tests are performed to the standard of ASTM D7091. Additional test methods have their own ASTM and ISO standards.

ADVANTAGES

- Non-destructive
- Contact-less
- Fast
- Minimal sample preparation

SAMPLE SIZE

A sample can usually be generated from the supplied material, depending on overall size. If you are unsure, we can advise whether a material is suitable for testing.

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2. SOLDERABILITY

QA/QC USE:

This technique is used for investigations into solderability issues identified during the manufacturing process, or in the event of failures in service.

WHAT IS THE TECHNIQUE?

This technique simulates the process of contact between a solder and the material a solder should wet to. The testing is performed on a wetting balance, where it measures the wetting time and force from contact to wetting force generation.

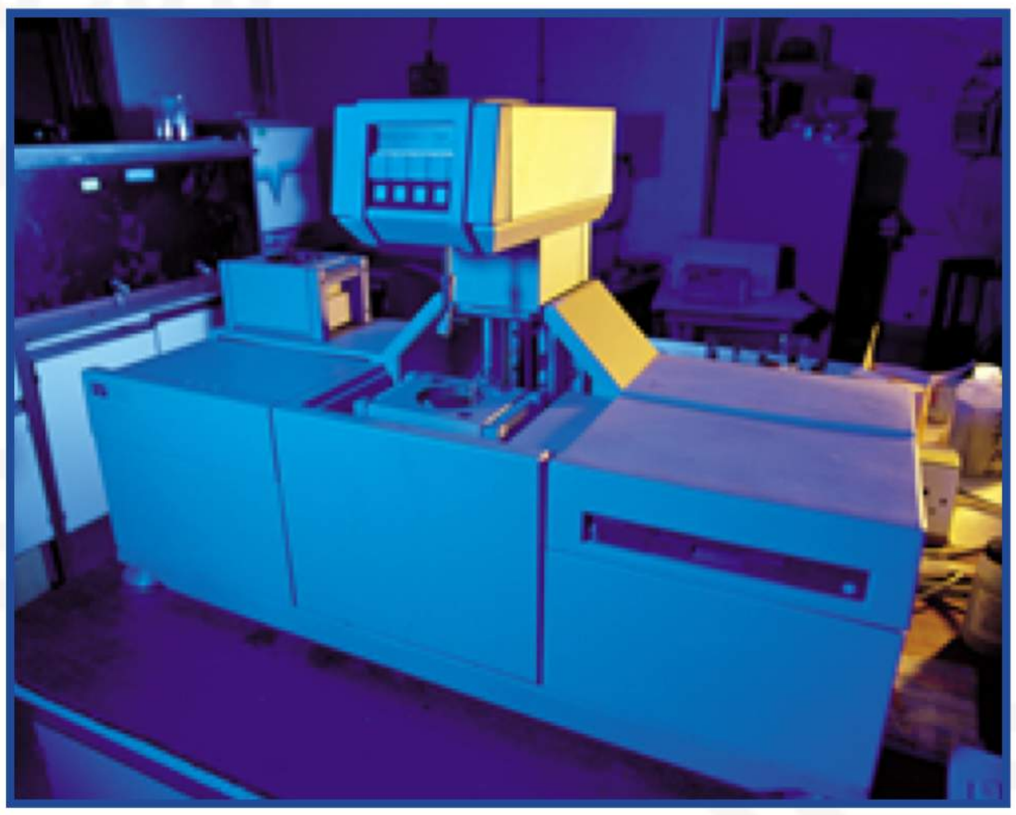
In solderability testing for quality control and assurance, there are three variables that can be changed to assess the quality of the solderability: the solder, the test sample and the flux.

By keeping two variables the same, the third can be changed enabling soldering performance to be directly compared. Testing can also be carried out on samples before and after storage or after artificial ageing, to assess shelf life.

STANDARDS AND TYPICAL APPLICATIONS

All solderability tests are performed to IPC-J-STD-002 and ASTM B678 - 86 standards.
Other than quality assurance and quality control, this test can be used for:

- Evaluation of printed circuit board coating
- Evaluation of the solder
- Evaluation of the flux
- Benchmarking



ADVANTAGES

- Accuracy
- Consistency and comparability with previous tests of the same component to identify a quality trend
- Ability to assess whether components are likely to solder under certain conditions

SAMPLE SIZE

Electronic components or solders can both be examined. A sample can usually be generated from the supplied material, depending on overall size. If you are unsure, we can advise whether a material is suitable for testing. The greater the sample size, the greater the reliability of the test. However, this also increases the cost, so we are happy to advise on an appropriate size and number of samples.

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3. X-RAY INSPECTION

QA/QC USE:

This non-destructive testing method is used for the inspection of PCBs or products to identify potential causes of failure, prior to delivery to the customer. It is also used for investigation into components or products once a failure has been identified.

WHAT IS THE TECHNIQUE?

X-Ray Inspection uses x-rays to examine components' features and solder joints, specifically those that are not otherwise visible.

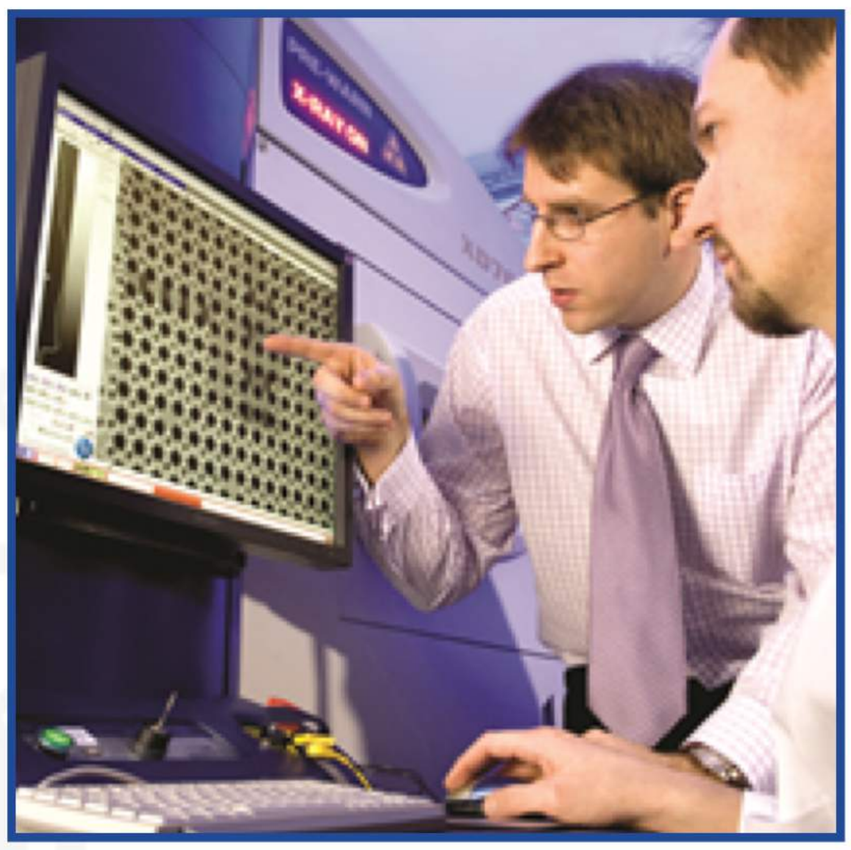
The object can be examined at angles up to 70 degrees, from a full rotation of 360 degrees, allowing identification of open joints, where possible.

STANDARDS AND TYPICAL APPLICATIONS

Performed to the standard of IPC-J-STD-001 E for hole fill of through hole joints.

X-Ray Inspection has many other typical applications, which include:

- Voiding within a material
- Final assembly testing
- Structural mechanics
- Weld verification
- Skeletal structure of small animals
- Enclosed/encapsulated items in larger assemblies



ADVANTAGES

- Non-destructive
- Contact-less
- Fast
- Minimal sample preparation

SAMPLE SIZE

A variety of samples can be accepted, with the sample being generated from supplied material.

If you are unsure, we can advise whether a material is suitable for testing.

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4. CROSS-SECTIONING

QA/QC USE:

This destructive testing technique is used either to ensure conformity to specification, or post-failure, where a non-destructive testing technique has not identified the cause of the problem.

WHAT IS THE TECHNIQUE?

Cross-sectioning is a simple technique that can be used in conjunction with many other tests to ensure the sample has been inspected thoroughly.

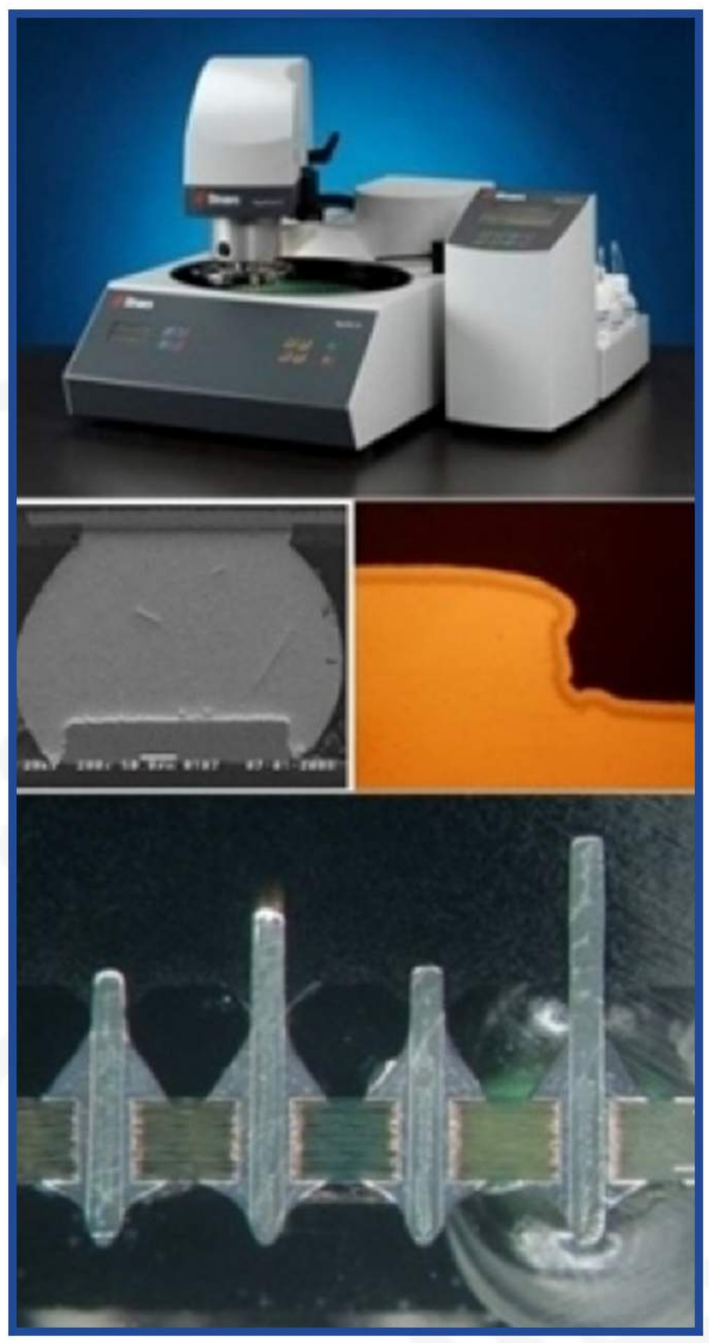
The component or soldered joint is located and isolated using a destructive method that accurately cuts out a two dimensional slice which is polished flat to allow inspection.

For quality control, a number of samples would be compared to ensure consistency across components and soldered joints.

STANDARDS AND TYPICAL APPLICATIONS

All testing is performed to PC-MS-810 and ASTM E 3 standards. Cross-sectioning is a multi-purpose testing technique that can be used for an array of other applications, including:

- Failure analysis of components and materials
- Quality analysis of PCB and solder structures
- Analysis of wave solder fill
- Inspecting voids in solder joints
- Analysis of the de-lamination of PCB material
- Manufacturing accuracy assessments



ADVANTAGES

- By gradually receding the sample back, a flat surface can be maintained therefore meaning that complex samples with various adjoined materials can be analysed together, rather than separately.
- Precision in locating the area of focus, and getting as close as possible to it.

SAMPLE SIZE

Small plate sample approximately 20mm x 20mm.

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5. MICROSCOPY

QA/QC USE:

The microscope is one of the most versatile instruments in the world and has many applications for quality control and assurance purposes.

WHAT IS THE TECHNIQUE?

A microscope with visible light is used to magnify a sample to reveal minute microstructures. This can then be continued by using Scanning Electron Microscopy with greater resolution and magnification to examine the sample further.

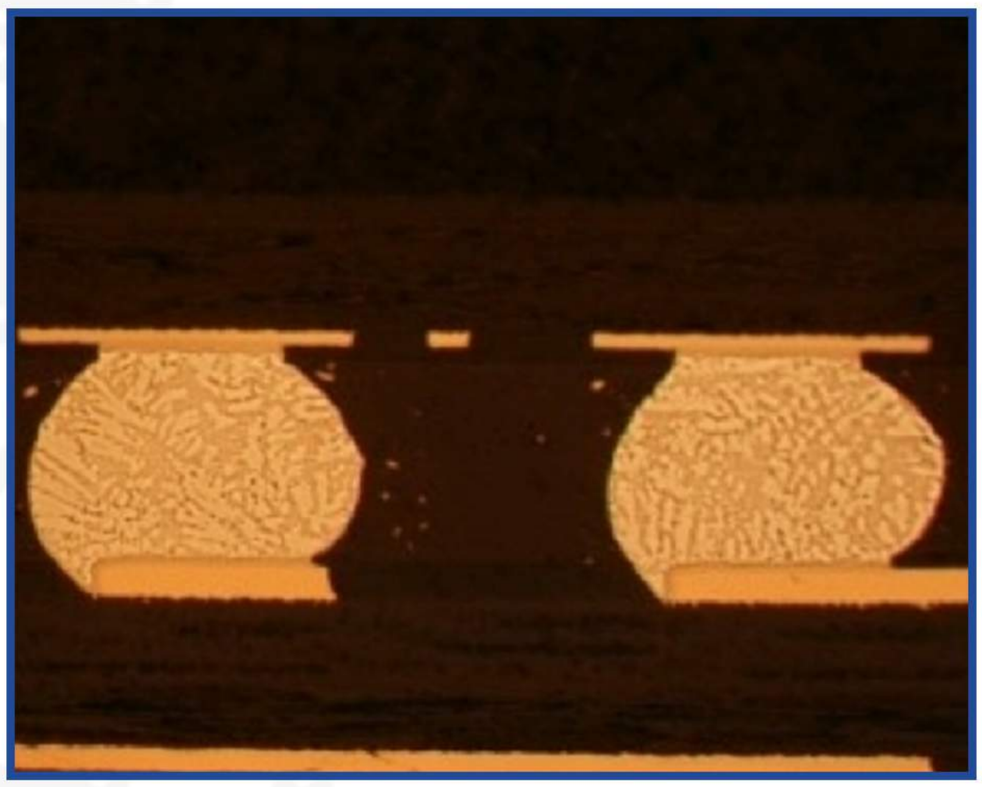
The machine used can also be fitted with an Energy Dispersive X-Ray detector, which determines the elemental composition of the sample.

This allows sample characterisation, identification of surface contamination, impurities and whether the correct material has been used in manufacturing.

STANDARDS AND TYPICAL APPLICATIONS

This technique is carried out to the standard of ASTM E2809.
Other typical applications that this testing method can be used for:

- Analysing surface fractures
- Providing microstructure information
- Examination of surface contamination
- Identification of spatial variations in chemical compositions
- Identification of crystalline structures
- Identification of intermetallic compounds
- Describing a composite construction
- Provides evidence of heat treatment



ADVANTAGES

- No need for sample pre-treatment
- High resolution, three-dimensional images
- Fast
- Data can be provided in digital form

SAMPLE SIZE

A variety of samples can be accepted, with the sample being generated from supplied material.

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6. JOINT STRENGTH

QA/QC USE:

This technique is used to compare solders and solder reflow/wave profiles for product applications where joint strength is particularly important.

WHAT IS THE TECHNIQUE?

Testing the strength of solder joints can be carried out in a variety of methods, all of which are destructive.

The most common technique used is the shear test, which involves a flat test face being pushed against the side of a chip component, such as a resistor or capacitor, until it fails. The load to failure is recorded, and also the nature of the failure.

Lead terminations can be tested by the tweezer pull test. The lead is gripped and pulled by the tweezers until failure occurs. Again, the load and nature of the failure is recorded.

STANDARDS AND TYPICAL APPLICATIONS

This method is performed to the standards of ASTM D1002 - 10.

Other typical applications that this testing method can be used for:

- Benchmarking
- Investigation of optimum soldering process

ADVANTAGES

- A direct comparison can be achieved between boards with different characteristics, such as solder alloys or reflow profile, to determine the best solution.
- Alternatively, it can be used periodically to check that a process or product is still in control.

SAMPLE SIZE

A variety of samples can be accepted, with the sample being generated from supplied material.

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About ITRI Innovation

ITRI Innovation is the trading name of the laboratories of ITRI Limited and comprises a team of scientists and engineers who employ analytical techniques across multiple business sectors.

Accredited by UKAS to ISO 17025 (No.4119) ITRI Innovation is a key global provider of contract testing and consultancy services to a broad customer base including:

- Aerospace
- Automotive
- Electronics
- Mining
- Minerals
- Polymers
- Telecommunications
- Energy and Environment




Headquartered in the South East of England our laboratory is run by a team of scientific and product development professionals involved in chemical, physical and microstructure analysis, materials testing, process engineering, product design and failure investigation.

ITRI Innovation's clients include: Brother, Henkel, Moog, Renishaw, TT Electronics, Ultra Electronics, WL Gore & Yamaha.

For more information on quality assurance and control testing options:

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