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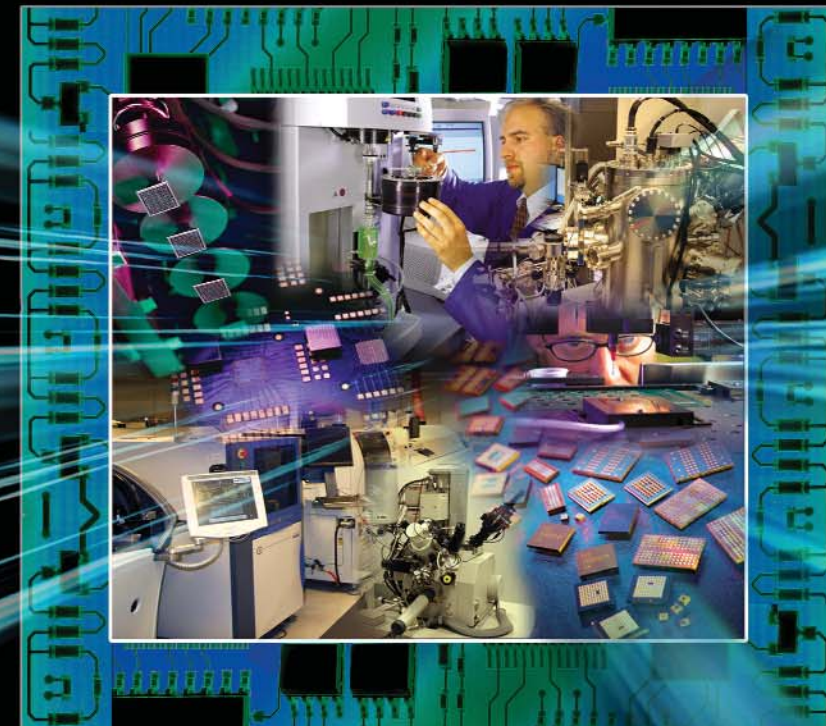
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ADVANCED PROCESS LAB



into the future...

Universal Instruments' Advanced Process Lab... into the future

In today's high-tech industries, knowledge makes the difference. Universal Instruments' Advanced Process Laboratory (APL) is positioned to deliver the expertise needed to maximize competitive advantage.

Founded in 1987, the APL has earned global respect as a valuable knowledge resource, helping manufacturers worldwide to enhance yield, achieve continuous process improvements, and optimize product reliability and lifecycle. The APL addresses design, layout, process and reliability concerns to ensure a comprehensive full-process solution for your manufacturing challenges.

Services

- Root Cause Failure Analysis
- Process Audits and Support
- Prototyping and Product Development Support
- State-of-the-art Production, Analytical, and Processing Equipment
- Material Evaluation



Partnering with the industry's technology leaders

Want to stay ahead of the competition? The APL plays a leading role in the greater electronics community, organizing research consortia, and partnering with the industry's leading academic and technology experts to identify and develop new and emerging technologies - those that will take electronic assembly far into the future.

Consortia activities help generate applicable knowledge for specific product development and manufacturing processes. This research is funded by a consortium of companies that share the results. Each year the laboratory chooses a set of relevant projects on current and emerging technologies. The 2009 consortium had over 30 members representing leading companies in the electronics assembly industry. Past projects have included topics such as ultra-fine pitch, BGA, CSP, flip chip, PCB technologies, optoelectronics packaging, and assembly for thermal management.

get a **quality product** to **market fast!**

Universal Instruments delivers complete factory-wide process, manufacturing and support solutions from prototyping to volume production. Next generation applications, like Flip Chip, SiP, and PoP? No problem. From product concept... throughout the entire product lifecycle, a technology partnership with Universal's APL ensures you get a quality product to market quickly and efficiently.



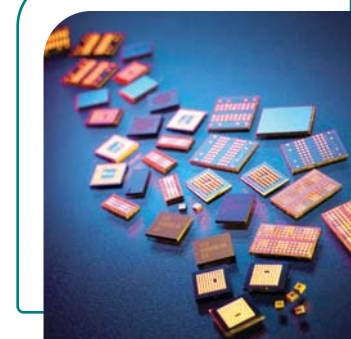
- Process and Material Research and Development

- Product Layout and Design
- Process Design
- Applications Review

- Process Development
- Process Solutions
- Prototyping on Manufacturing Equipment

- Process Optimization
- Design for Manufacturability
- Process and Equipment Optimization
- Reliability Testing
- Qualification

- Assembly Equipment Solutions
- Integrated Process Solutions
- Process Scale-up
- Failure Analysis
- Incremental Production
- Capacity Increase
- Worldwide Scalability
- New Products Support



- ISO 9001 certified
- ITAR compliant

AP Laboratory Services – Root Cause Failure Analysis

The information you need to enhance performance and profitability

Your response to production or field failures is critical to your business. Reacting swiftly, decisively and fairly secures your reputation and resolves issues that will otherwise destroy profitability. But to achieve it, you must locate and rectify the root cause immediately.

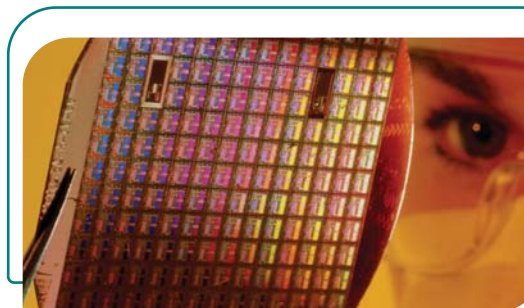
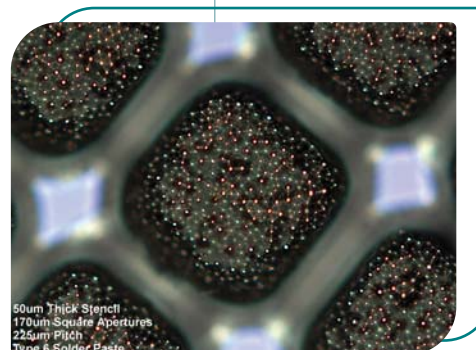


That's a big task when you are working with the most advanced components, leading-edge materials and techniques, and cost-sensitive assemblies. You need specialized tools to look beneath the surface of chip scale components, solder joints, circuit boards, and associated materials. You need the knowledge to manipulate those tools, and you need expertise across many disciplines to correctly interpret the results. Take the fastest and most cost-effective route to the failure data you need – Universal's APL Failure Analysis Services. We have already invested in specialized, precision analytical tools, and the knowledge of Topic Experts whose collective expertise covers every packaging and assembly technology in depth.

Your strategic advantage

The Advanced Process Lab has developed critical manufacturing processes for all component families. The APL builds on Universal's expertise in helping customers shape ideas into products. We actively participate in product development and design activities. Our experience positions us to deliver failure analysis that adds real value to your business:

- Identify and rectify the root cause of the defect
- Increase production yield
- Improve field reliability
- Provide evidence to support product liability cases or vendor returns
- Deliver rapid return on investment (ROI)



The technology to succeed

The APL provides detailed analysis of sample packages, including characterization of inherent weaknesses and recommendations to enhance product lifetime and yield.

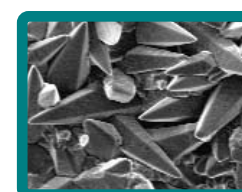
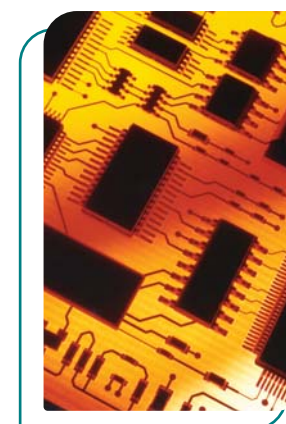
Component-level Interconnect/PCB Failure Analysis:

- Microanalysis of failures
- Dye penetration, cross section, shear test
- Solder rupture and inter-facial failure modes identified
- Prediction of "time zero" and long term field failures
- Contamination studies
- EOS/ESD die failures
- PCB fabrication problems

Proven return on investment for assemblers

We have helped OEM and EMS assemblers to save big on scrap, rework and warranty costs

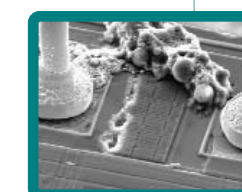
- Polarized light analysis quickly highlighted serious cracks in a batch of LEDs that had shown intermittent behavior in an OEM instrument panel. Our failure analysis also showed these cracks to be present at the point the LEDs were received at goods-in. Our inexpensive analysis and rapid reporting pinpointed the problem, proved liability, and saved the customer over \$250,000.
- Using scanning electron microscopy and energy-dispersive x-ray analysis, we quickly determined that the surface finish applied by the board fabrication house did not conform to the product specification ordered by the customer. Our analysis allowed the assembler to return boards for credit and insist future boards be finished to specification. Estimated saving to the customer: \$100,000.



Plated Copper



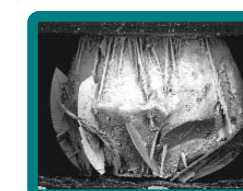
Dendrites



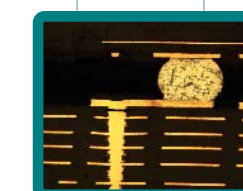
EDS failed die



Dry film lock-in void



Etched, thermal-cycled, lead-free solder



PTH barrel crack

AP Laboratory Services – Process Audit and Support

Optimize your response to production and enterprise targets

Assembly process performance is crucial to profitability and market reputation. The most cost-effective route to the streamlined, efficient assembly flow you're looking for is to trust Universal's APL experts to optimize and refine your processes.

Our rigorous Process Audit services will help you meet product, corporate or environmental targets, implement continuous improvement, and direct future investment. We have already acquired the knowledge you need by studying and developing each new assembly process, from its arrival as a cutting edge technology through to maturity. Our laboratory is equipped to analyze and fine-tune materials, process parameters and procedures. Let us work with you to achieve the highest levels of throughput, yield, efficiency and quality.



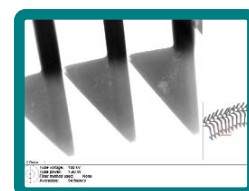
Delivering measurable improvement

The Advanced Process Lab builds on Universal Instruments' industry-leading expertise in helping customers shape ideas into products. Process Audit equips you to meet targets for:

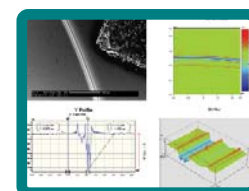
- Yield
- Quality
- Efficiency
- Throughput
- Improved Product Reliability



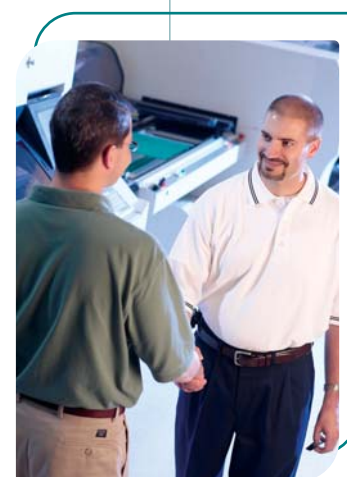
Shadow Moiré



X-Ray



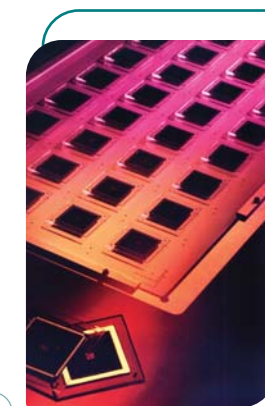
Topographical profiling



Dialogue and deliverables

The Process Audit follows an established methodology, and is conducted with your full participation to deliver the expected improvements.

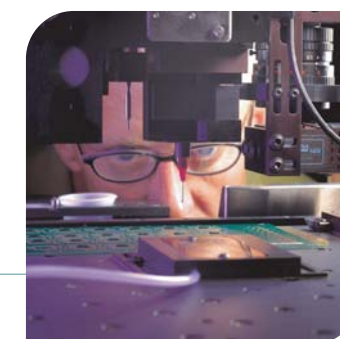
- Review application including assembly processes, materials, quality standards
- Determine current assembly yield (and reliability) issues
- Perform process audit
- Document and present process audit findings
- Discuss findings and recommend changes to assembly process and/or materials
- With your approval, implement agreed Process Audit recommendations
- Review improvements
- Deliver final report



Comprehensive attention to detail

We understand the factors that determine assembly performance:

- In-depth analysis of selected materials: PCBs, components, adhesives, solder paste, flux, encapsulation, materials, underfills
- Skills, knowledge, and research into all assembly processes: pre-placement, placement, reflow, underfilling
- Advanced packaging expertise: wafer bumping, package assembly, ball attach



Benefits: far-reaching, proven

For many customers, the process audit has allowed even greater advantages by leveraging the AP Laboratory Services portfolio:

- Process audit begins a dialogue with Universal laboratory services for future applications
- Identify issues that cannot be addressed on-site
- Direct data feedback to the Advanced Process Lab at time of audit
- Mutual understanding reduces the time to resolve future issues
- Process audit identifies and helps to transfer "new" technology

Direct cost savings

Better processes deliver big savings as well as product and output advantages:

- Reduced material costs through lower rework and process optimization
- Reduced labor costs through lower rework and less unplanned maintenance
- Assembly efficiency increase by reducing assembly time and process steps, delivers:
 - Fast pay-off on capital equipment
 - Lower utility costs
 - Increased opportunity for equipment maintenance – increased equipment reliability
 - Reduced work in progress

AP Laboratory Services – Prototyping and Product Development Support

Skills and technologies for advanced product development

To create is a tougher challenge than to replicate. If your business is prototyping cutting-edge products using state-of-the-art technologies, you know what we mean. But to meet modern product development timetables, you need direct access to the advanced knowledge each new product demands. Universal's APL prototyping services will help you solve difficult assembly issues quickly and cost-effectively, to confidently prepare for volume production. From initial consultation, to first article build and new product introduction, you can rely on our experienced Laboratory Services staff and advanced research and development facilities. Use our prototyping services to quickly deliver quality-engineered products and gain valuable market advantages.

Engineer success into each new product, from the start

The Advanced Process Lab builds on Universal's industry-leading expertise across all production environments. OEMs and prototype specialists leverage our skills at all stages, for fast turnaround and cost-effective, reliable, high quality products:

- Cutting-edge knowledge gained from our process, materials, and reliability research
- Expertise to assemble complex devices involving new components, materials, products, and processes
- Industry-first equipment innovations to overcome difficult prototyping challenges
- Technology-inspired design for manufacture
- First article build, product and process development
- New product introduction including process transfer to your site, your chosen CEM, or a CEM recommended by the APL.



IVUS catheter



Flip chip to FR4 application



Medical application with 14µm lines and spaces



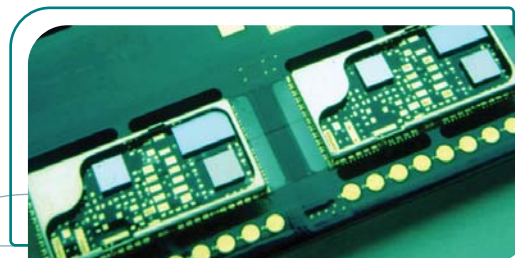
Medical application with 70µm-pitch flip chip



Short-cut the learning curve for emerging technologies

We utilize the knowledge developed in our research to select materials, and design and develop processes:

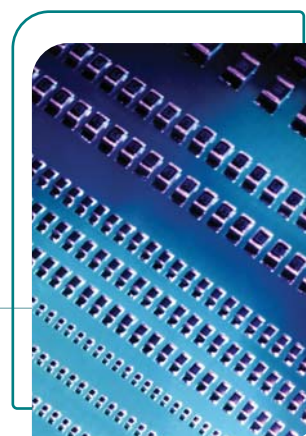
- Lead free
- BGA
- Flip chip
- Fine pitch CSP
- Advanced interconnect technologies
- Advanced, automated back-end assembly
- POP (Package on Package)
- SIP (System in Package)
- MLF



Services from pre-prototype to post-production

Access the APL's prototyping services skills and technologies at the beginning of each project, and through to completion:

- First article build for proof of concept
- Design review of components and materials
- Assistance with component selection and PCB design
- Material selection assistance
- Assemble complex products involving new components, materials, products and processes
- Process development for unusual assemblies
- Recommendations for yield and reliability improvement
- Optimization of process parameters
- Develop basic processes for duplication at manufacturer's site
- Process implementation at manufacturing site



Superior results

Universal's APL prototyping services engineer superiority into the product and processes, delivering an inherent advantage in tough, global markets:

- Robust processes for high yield assembly, from the start
- Shortened development cycle and time to market
- Highly cost-effective process implementation.

We have completed several hundred prototype projects for customers within the last 12 months alone, using state-of-the-art assembly lines at the Binghamton Advanced Process Laboratory.

AP Laboratory Services – Equipment

Capital Investment For World-Class Laboratory Services

As a customer of Universal Advanced Process Lab, you are supported by our extensive investment in automated electronics assembly and specialized analytical and processing equipment. The globally-respected APL is equipped to accurately reproduce processes from prototype, high-mix, and high-volume production lines world-wide, and to support detailed analysis of the characteristics and results.

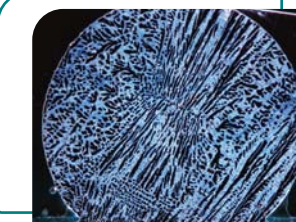
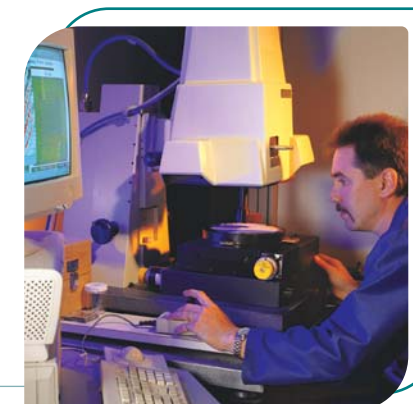
The APL makes a unique contribution to the world's electronic industries: its capabilities extend beyond the scope of most commercial organizations, comprising equipment, skills, and competencies that often cannot be achieved within the OEM or EMS sectors. We are equipped to find the answers you need to improve and advance your processes, materials and component technologies.



Analytical Laboratory

Benefiting from 20 years of continuous expansion of our analytical capabilities to support cutting-edge research with leading consortia and institutions, the Laboratory Services portfolio offers the scope to locate the root causes of any failure or process issue encountered in series production:

- Environmental scanning electron microscopy
- Non-destructive imaging including high resolution x-ray and scanning acoustic microscope
- Thermal analysis, including Dynamic Mechanical Analyzer, ThermoGravimetric Analyzer, Fourier Transform Infra Red, and Differential Scanning Calorimeter
- Dimensional characterization, including wafer bump measurement, and precision linear displacement measurement
- Cross-sectioning, including cross-section polishing and micro hardness testing optical inspection, including high resolution hot stage stereo microscopy
- Image capture, including professional digital microscope cameras and high-speed photography
- Extensive materials characterization equipment, including viscometry, electromigration, and wettability testing
- Accurate, digital mass measurement
- Temperature profiling and oxygen analysis for accurate process characterization
- Reliability monitoring, including electrical event detection, and programmable DMM
- Akrometrix TherMoiré warpage measurement
- Zeiss Supra 55 VP, analytical ultra-high resolution FESEM + EDAX Pegasus EDS
- PHI 5000 VersaProbe X-ray photoelectron spectrometer
- FEI FIB: dual-beam-SEM/FIB
- JEOL TEM: 200-kV field emission transmission electron microscope
- GC/MS - gas chromatograph / mass spectrometer
- ICP - inductively coupled plasma
- IC/MS – ion chromatography / mass spectrometer



Production simulation and manufacturing test

Our in-line assembly and production test facility is capable of accurately replicating your own highly automated production routines and processes. This way we can recreate the conditions you face every day and gain data that is directly relevant to your application:

- Screen printing including high-end DeK® Infinity and Galaxy platforms
- Universal linear motor component placement platforms
- Vitronics-Soltec forced convection reflow ovens, with nitrogen
- Asymtek underfill dispensing
- Cyberoptics automated vision inspection
- Metcal and AirVac rework stations including BGA and CSP capability



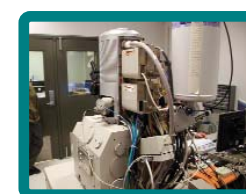
Environmental Test Equipment

We are fully equipped to carry out accelerated lifetime testing, and to simulate operating conditions that will allow you to penetrate markets such as automotive and aerospace with complete confidence:

- Environmental/test chambers including thermal shock and liquid-to-liquid shock
- Air-to-air thermal cycling chamber
- Temperature and humidity chamber
- HAST/sealed temperature/humidity chamber
- Forced and natural convection ovens
- Nitrogen-capable vacuum oven
- Lansmont model 23D shock table: hot/cold testing -40C to 100C
- 1250 lb LDS shaker/slip table and amplifier with Cincinnati sub-zero environmental chamber



APL production line



FEI dual-beam FIB



Metallurgical sectioning lab



Perkin Elmer material analysis equipment



PHI XPS system



APL production lines