

# Expertise, technology, and gases . . .

a total solution for the global  
electronics packaging, assembly  
and test industry





“Our objective is simple — we use our 20+ years of global experience to deliver the expertise, technology and gases to help you improve your productivity and optimize your total cost of ownership.”

**Gregory Arslanian,**  
Global Application Engineer

Smaller devices. Lead-free solders. No-clean flux chemistries. In the electronics assembly and packaging industry, you are constantly adjusting to something new. At Air Products, we are with you every step of the way to help you achieve greater profits with fewer defects. Our expertise, technologies and gas supply advantages can provide improved profits, uptime, defect reduction, and an overall improvement in the total cost of ownership for your integrated circuit (IC) packaging and printed circuit (PC) board assembly processes.

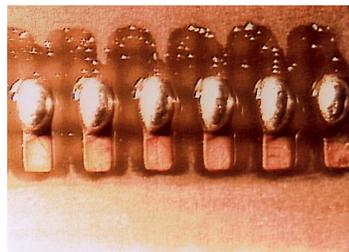
We have a dedicated team of application engineers providing local and regional support to customers in every region of the world. Our Electronics Packaging, Assembly and Test (EPAT) Group’s breadth of experience, understanding of evolving customer needs, and shared best practices bring the advantage to your business. This multitalented EPAT team offers diverse capabilities and is constantly evaluating programs, including: developing gas and process technology such as fluxless soldering research and understanding the effects of atmosphere composition, and then bringing these developments commercially to our customers; providing process technical support to customers, including problem resolution, process optimization, and cost reduction programs; conducting industry-relevant R&D activities with joint development projects with customers, such as lead-free soldering, production trials, and cost of ownership models.

#### Self-alignment, lead-free solder paste offset printing air versus nitrogen reflow

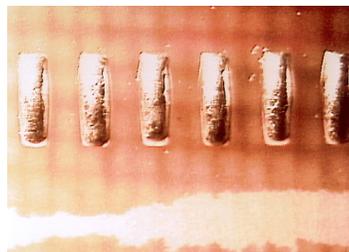
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Offset printing of solder paste on printed circuit board pads.



Reflowed in air atmosphere, poor wetting and high concentration of flux residue.



Reflowed in nitrogen atmosphere, excellent wetting and minimal to no flux residue.

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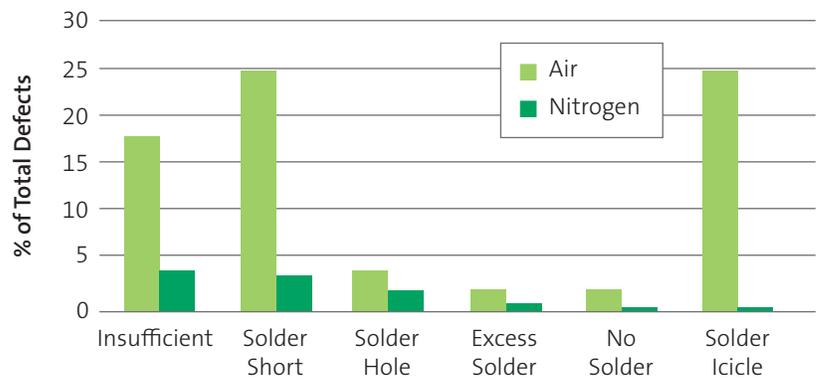
## Technologies That Enable Your Success

At Air Products, we are focused on being the total solutions supplier to the global electronics assembly and packaging industry. Innovative solutions from Air Products include:

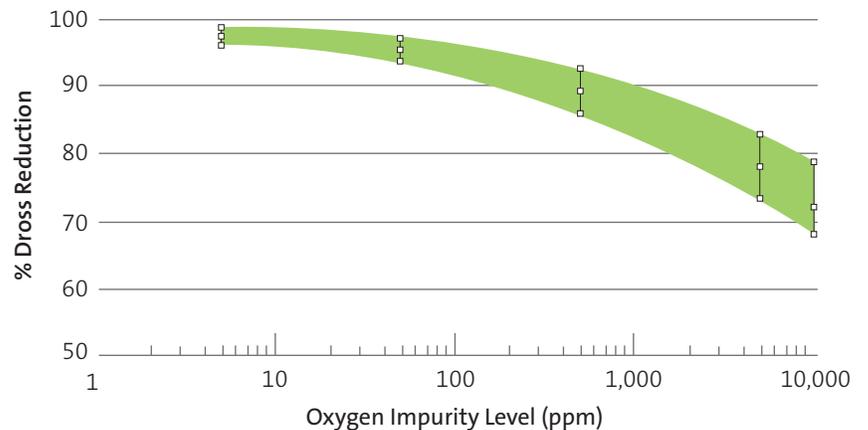
**NitroFAS™** – This optimized technology addresses the major issues faced by the assembly and packaging industry by providing nitrogen inerting in wave soldering applications. Through production trials with an Asian-based electronics assembly company, the NitroFAS technology was able to reduce the key defects by 90% to achieve improved production efficiencies and cost savings.

**Electron Attachment** – A novel, proprietary technology based on electron attachment for fluxless wafer bumping and copper oxide reduction, this unique and environmentally-friendly technology works at ambient pressure and low temperatures by using nonflammable concentrations of hydrogen. The electron attachment technology promotes the dissociation of hydrogen molecules into electrically charged species to allow for the reduction of solder alloy oxides at lower temperatures than conventional flux based solder alloy oxide reduction processing. This technology will promote solder alloy oxide reduction at the melting point or slightly above it.

**NitroFAS technology helps an electronics contact assembly company reduce wave solder defects by 90%. Dross formation was reduced by 96% in day-on-day production rates for an annual savings per unit of US\$35,000.**



## Inert Gas Wave Soldering – dross reduction versus atmosphere purity





## The Right Gas Supply Solution

To complement our technologies, we offer the complete portfolio of reliable gas supply options from liquid/bulk gases to a host of on-site production technologies. Whatever your purity requirements, volumes, and usage needs, we can deliver the right gas supply to meet your exacting process requirements day in and day out.

**Liquid/Bulk Delivered Gases** – Whether your application requires nitrogen, oxygen, hydrogen, argon, helium or a blend of gases, you'll benefit from our proven experience supplying bulk gases to the electronics industry. Stored in tanks at your site and vaporized as needed for your process, our in-house fleet of computer-dispatched tankers and our trained drivers enable us to quickly fulfill your gas supply requirements.



**On-Site Generated Gases** – Air Products offers a full line of on-site nitrogen generation systems which provide significant savings compared to traditional supply methods. Our High Purity Nitrogen (HPN) plants provide cryogenic-purity nitrogen at 15,000–38,000 standard cubic feet per hour and at a substantial savings compared to hauled-in liquid nitrogen. These HPN plants feature a compact design and easy installation, giving you a dedicated production facility with backup supply. For other processes and applications, our PRISM® PSA or membrane noncryogenic systems can provide on-site generated nitrogen with potential cost savings of up to 50 percent compared to traditional supply modes.

### Benefits of nitrogen inerting

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#### For Reflow Soldering

- Elimination of metal surface oxidation
- Improved wetting of solder to component leads and board
- Reduction in overall soldering defects
- Compatible with low residue flux solder pastes
- First pass soldering yields improvements
- Labor cost reduction
- Easier post-soldering cleaning (when required)
- Wider process window

#### For Wave Soldering

- Reduced oxygen in soldering atmosphere
- Improved solder wetting
  - Increased force
  - Decreased wetting time
- Reduction of flux volume per board by utilization of less active flux chemistry
- Dramatic reduction in dross formation = less cleaning
  - Reduced equipment maintenance = reduced costs
  - Lead-free solder is 3 to 6 times higher in cost than lead-based solder
- No-clean process can be implemented
- Solder ball formation minimization
- Wider process window/increased uptime
- Defect reduction

# Working together

Looking to improve your process? Utilizing knowledge applied at our worldwide customer base, Air Products' global team conducts on-site audits to evaluate your manufacturing process and address your concerns. The site audit can provide realistic process cost savings and improvements, including recommendations for improving uptime, achieving higher productivity, and lowering manufacturing costs, as well as process enhancements that can be achieved utilizing atmospheric gases.

See the following page for two summaries of audits we performed at customers' facilities for "real world" examples of improved productivity and reduced defects.



# the use of nitrogen improved their defect levels by 56%

## Real World Process Audit

Experiencing nonwetting, nonsolders and bridging defects with SMT production lines, a large electronics manufacturing company brought in Air Products to evaluate inert atmosphere processing. Utilizing a temporary nitrogen supply system to the reflow furnace, Air Products' application engineers optimized the nitrogen to customer-specified oxygen ppm levels with a production run for one month. Through the evaluation, the customer's quality inspection report found that the use of nitrogen improved their defect levels by 56% with better solder joints, good wetting appearance, reduced oxidation of component leads and a reduction in the AOI fault list. The company found the results to be so beneficial that they now utilize Air Products' nitrogen and technology in their SMT production lines.

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# annual savings per unit of \$35,000

## Real World Technology Audit

A large contract assembly house turned to Air Products to achieve lower defects, and in turn, a reduction in solder dross for their wave solder processing lines. The assembly company's primary concern was several major solder defects that were very difficult to repair and required costly manual rework. An investigation was conducted utilizing Air Products' proprietary NitroFAS retrofit technology to introduce nitrogen into the wave solder process. The test program was run for one month with a defect reduction of 90%. During review of the program, the assembly house found the NitroFAS technology had reduced dross formation and solder oxide by 96% in day-on-day production rates. While not the primary goal of this evaluation, the dross reduction, and hence the significant reduction in the amount of virgin solder required, provided the company with an annual savings per unit of \$35,000. This added benefit was able to provide more production uptime and a reduction in material costs.

By partnering with our EPAT applications team, you gain access to this broad range of established and leading-edge application technologies.

**We support customers in diverse applications and technologies such as:**

Ceramic metallization

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Brazing

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Plasma cleaning of IC packaging assemblies

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Flat-panel displays (IC assembly)

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Fiber optics

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Thick film firing

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Thermal and environmental cycle testing

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Glass-to-metal sealing

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Lead-free soldering processes

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PCT plasma desmear and etchback

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Fluxless soldering technologies

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Drybox inerting

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Flip chip technology and processing

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Chip-scale packaging and assembly

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Backed by the technical and research staff at Air Products' Advanced Technology Center, our global EPAT team investigates current technologies in conjunction with the future assembly and packaging processes that are being developed to accommodate the new generation of integrated circuits. Through these efforts, we are able to combine the latest technological developments with hands-on process knowledge to improve customer operations, using our labs to aid you in troubleshooting and sample analysis.

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### **Safety Is Key**

For us, safety is just the proper way to do business. We continually enhance and update our safety capabilities, and our safety services are available for everything from employee training on the safe use of our gases at your site to a complete review of your total atmosphere system from delivery to the point of use.

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