ATmaP™ (Accelerated Thermo-Molecular Adhesion Process)
Executive Overview

ATmaP™ is an innovative patented one step process for treating a range of materials (e.g., Plastics, Glass, and Metals) prior to painting or bonding without the need to use Adhesion Promoting Primers. ATmaP™ is an acronym for; Accelerated Thermo-molecular adhesion Process.

ATmaP™ is the process of grafting a nitrogen-based coupling agent to the surface of a material being treated via atomization and vaporization through the center of a Cirqual® gas burner. When the Cirqual® flame (with the atomized and vaporized coupling agent) contacts a component being treated, it chemically bonds oxides of Nitrogen into its surface. ATmaP™ is an environmentally friendly process, with no discharge of VOC's or abatement.

Current technologies, such as adhesion promoters, conventional flame treatment, corona discharge and plasma chambers are unable to match the levels of adhesion achieved by ATmaP™. ATmaP™ exceeds current OEM requirements for industry standard adhesion tests such as; Stone-chip Resistance, Gasoline Soak, Mandrel Bend, Water Jet, Thermal Shock, Humidity, Chemical Resistance, Lap Shear, and Cross Hatch etc.

ATmaP™ Performance Standards:
DaimlerChrysler in July 2003 issued a Global Process Specification (PS-10789) for use of the ATmaP™ technology on painted exterior TPO/PP.

General Motors Holden has also tested the ATmaP™ process on interior and exterior painted TPO/PP, with ATmaP™ exceeding current GMH performance specifications.

The ATmaP™ Process Offers The Following Benefits:

- Increased Adhesion without the use of Adhesion Promoters
- Cost Reductions
  - Substantial reductions in energy consumed in production process
  - Faster process time (no primer oven required)
  - Allows for material substitution (recyclable and lower cost materials)
  - Reduced maintenance costs
  - No required abatement
  - Reduced floor space required verses current manufacturing processes
- Reduced use of solvents
- Improved first time quality via the Elimination of Adhesion Promoter 'Dirt'
- Reduced warranty claims through Increased Adhesion
- Environmental improvements (Elimination of Significant Amounts of Emissions)

Resulting In A Reduction in Total Manufacturing Costs Verses Current Adhesion Promoting Technologies

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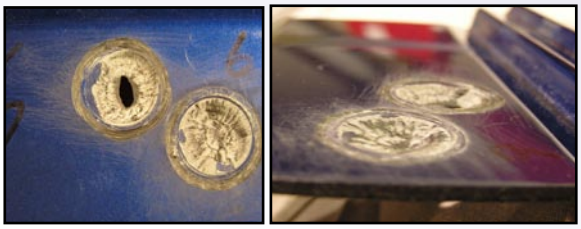
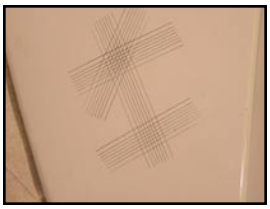
Performance Of The ATmaP™ Technology

ATmaP™ On Plastic (Pull Strength) 	An Elcometer, vertical pull strength test was performed on an ATmaP treated TPO bumper fascia that was painted without the use of Adhesion Promoting Primers. The resulting basecoat-to-material bond was so strong that a 100% cohesive failure of the substrate occurred at 1750 psi
When an Elcometer Test was performed on a regular production part (Adpro, Base, Clear System), the resulting facture point occurred between the ADPRO and material with zero cohesive failure of the substrate. This facture point occurred at 250 psi.	
ATmaP™ On Plastic (Open Time) 	A Cross Hatch Test performed on an ATmaP treated TPO body molding that was treated then stored for 5 months before being painted without the use of Adhesion Promoting Primers. The ATmaP treatment durability has been tested to 12 months with perfect results.
ATmaP™ On Plastic (Gas Soak) 	ATmaP™ treated materials that have been painted without Adhesion Promoters can withstand a Gas Soak in excess of 24 hrs without any loss of adhesion.
Adhesion Promoter, because of its reactivity to Gasoline, cannot match the same standards as its ATmaP™ counterpart. Failure occurred after only three hours.	

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Technical Overview Of The ATmaP™ Technology

ATmaP™ is a patented, one-step process that uses a Cirqual® gas burner attached to a robot arm in order to surface treat both, flat and three dimensional surfaces alike. However it is not the same as traditional flame treatment. A technical description of ATmaP™ is detailed below.

- A highly controlled flame delivered by the Cirqual® burner, using either natural gas or propane, is generated with control of oxygen content in the range of 0.2% - 1.2% depending on the material being processed.

- A diimine compound is solubilized in water at less than 10.0% mix ratio. This "water-borne" solution is injected into the flame via an internal mix spray gun, located in the center of the Cirqual® burner. The spray gun is highly modified to generate low velocities yet high atomization. The highly atomized liquid is vaporized within the flame and generates an active 'chemistry' which in turn is carried to the surface of the material / molding, by the flame itself. The total volume of liquid sprayed is no more than 25ccm.

- The atomizing media used is Nitrogen (oxygen free) at volumes of no more than 12 - 15 l/min. Nitrogen is used because it is an inert gas and therefore does not affect the O2 content of the flame itself. Nitrogen is also capable of, and reacts to, changes of polarity. One of the effects of combustion is to generate a small electric current. This 'charge' becomes an integral part of the overall chemistry generated which is transferred to / integrated with, the surface of the substrate. The net effect is to increase the polarity of the substrate.

- Hydroxyl, Carboxyl, and diimine-derived functionality's (oxides of Nitrogen) are chemically bonded into the surface of the substrate being treated.

- These functional groups cause variations in electro negativity across the surface of the part, which enhances adhesion (for painting/bonding & laminating etc.)

- More than 65 individual chemical reactions take place within the flame and on the surface of the substrate.

- The chemical bond is permanent and treated parts can be stored and painting/bonding & laminating etc. delayed for up to 12 months.

- The application traverse speed can be up to 2000 mm/second with treatment coverage being approximately 200 mm wide per pass.

- There are no EPA issues (no VOC's are used or produced by the ATmaP™ process and no abatement required).

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Added Benefits Of The ATmaP™ Technology

The ATmaP™ Surface Treatment Technology provides many additional benefits beyond the most prevalent; the elimination of Adhesion Promoting Primers. These added benefits could represent significant savings and/or improved efficiencies in manufacturing environments.

Less Environmental Waste Generated

The elimination of ADPRO will significantly decrease the amount of Sludge / Contaminated Water produced as a result of painting applications.

Less Solvents Required

Solvents will no longer be required for ADPRO thinning / mixing. Also, there will be the elimination of flushing operations for ADPRO fluid lines & spray guns. This also reduces amount the environmental waste caused by recaptured / contaminated solvents.

Less Energy Required For Abatement System

Reductions in VOC concentrations enable air volumes to be reduced in an abatement system, which results in the requirement for less energy inputs to achieve 100% VOC destruction.

Environmental Credits

Overall reduction in environmentally damaging discharges into the air and land

Reduced VOC Discharges

Less VOC emissions due to ADPRO can enhance product volume throughput due to freed-up capacity within VOC permits.

Reductions In Product Scrap

Improved FTQ due to the elimination of one coating and possible dirt contaminates that occur with an ADPRO system.

Reductions In Floor Space

Elimination of ADPRO ovens (If currently required), which can occupy as much as 30% of total floor space.

Reduced Maintenance Time & Costs

ATmaP™ equipment comprises of modular constructed units with wide process windows and operational tolerances. These components require less maintenance than current ADPRO equipment.

Reduced Warranty Claims

ATmaP™ provides improved adhesion when compared to current ADPRO systems.

Robotics

ATmaP™ does not require the use of intrinsically save and costly Paint Spray robots, which can be substituted with less expensive Industrial robots.

ADPRO Oven Costs (If Applicable)

No requirement for an ADPRO oven means significantly reduced energy consumption.

Material Substitutions

Cheaper and/or more recyclable materials can be used that currently do not poses adequate adhesion properties when used with existing ADPRO technologies.

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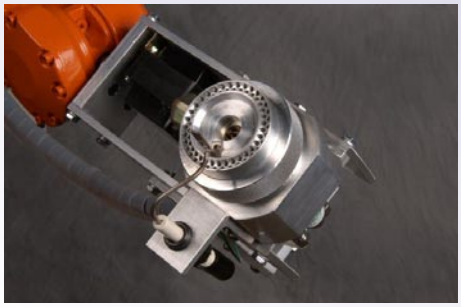
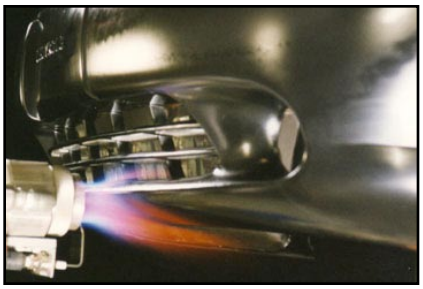
Cirqual® Burner Description

The patented Cirqual® burner is a very important part of the ATmaP™ process. It allows the ATmaP™ process to generate the required flame-chemistry and induce the necessary chemical modifications on the materials surface.

The Cirqual® Burner, with its lightweight aluminum construction, provides One Step processing of materials and has proven to reduce cycle times and produce a consistent, quality, surface treatment.	
	The Cirqual® burners radical three-dimensional 'mushroom' flame shape, three inches in diameter, allows for successful treatment to span eight inches in a single pass.
Intricate surface geometry is also overcome via the unique flame shape and its ability to spread upon contact, conforming to contours and wrapping around edges/parting lines.	

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Features And Benefits Of The ATmaP™ Process

Feature	Benefit
Increased Levels of Adhesion	Improved First Time Quality Improved 'Wettability' Promotes Even Paint Flow Forming a Consistent Layer with Better Wrap on Edges, Particularly on Designs with Sharp Edges Lower Warranty Claims Cheaper Substrates May Be Used Exceeds Current OEM Adhesion Standards
Large Open Process Window From Time Of Treatment till Coating	Treated Parts Have Been Successfully Painted 12 Months After Being ATmaP™ Treated
Flexible Manufacturing Opportunities	Offers Opportunities for Treatment to Occur Either Online or Off-line Treated parts can be stored up to 12 Months Prior to Painting Treated Parts Are Not Effected by Standard Power Wash Systems
Fast, One-Step Processing	Less Floor Space Required than Conventional Methods or Surface Pre-treatment Fast Processing Speeds (Example: Bumper Fascia = 35-45 Seconds)
No VOCs	No Abatement Required Environmental Credits Maybe Available
Very Low Energy Consumption	No Abatement Required Environmental Credits Maybe Available
Highly Controllable and Flexible Flame Dynamics	Able To Treat a Range Three-Dimensional Surfaces, Including Deeply Recessed light sockets and grills etc

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