

# INNOVATION

ACCE September 11th - 13th 2007

## FTS Technologies

Accelerated Thermo-Molecular Adhesion Process.  
(ATmaP®) - An Advanced Surface Treatment Technology.

Presented By: Russell Brynolf

# Introduction

- Objectives of Today's Discussions
  - Understand the need for change in the manufacturing process of painting and bonding of interior and exterior Thermo-Set and Thermo-Plastic materials and how that change will impact the environment - Automotive Plastics Industry.
  - Seek to understand The ATmaP® Surface Treatment Technology on painting and bonding of materials such as metals, plastics and composites.
  - To present the potential cost and environmental benefits.
  
- Present the ATmaP® Technology on Two Levels:
  - Technical
  - Environmental

# Current Production Process: Adhesion Promoter

- Low Solids / High Solvents
- Chlorinated Polyolefin's - CPO's
- VOC's - Typically **7 lbs/gallon**
- HAP's - Typically **2 lbs/gallon**
- Energy Usage - RTO's etc
- Green House Gases - e.g CO<sub>2</sub>

# ATmaP®

ATmaP® Is A Robust, Engineered Surface Treatment That Is Specifically Designed To Increase Qualities Of Adhesion To Polymeric Substrates. ATmaP® Combines Combustion Generated Covalent Reactions With Vaporized Chemical Coupling Agents To Permanently Modify The Surface Structure Via An Increase In Surface Functional Groups

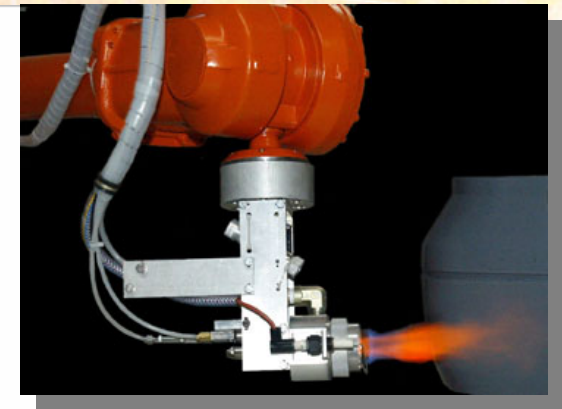
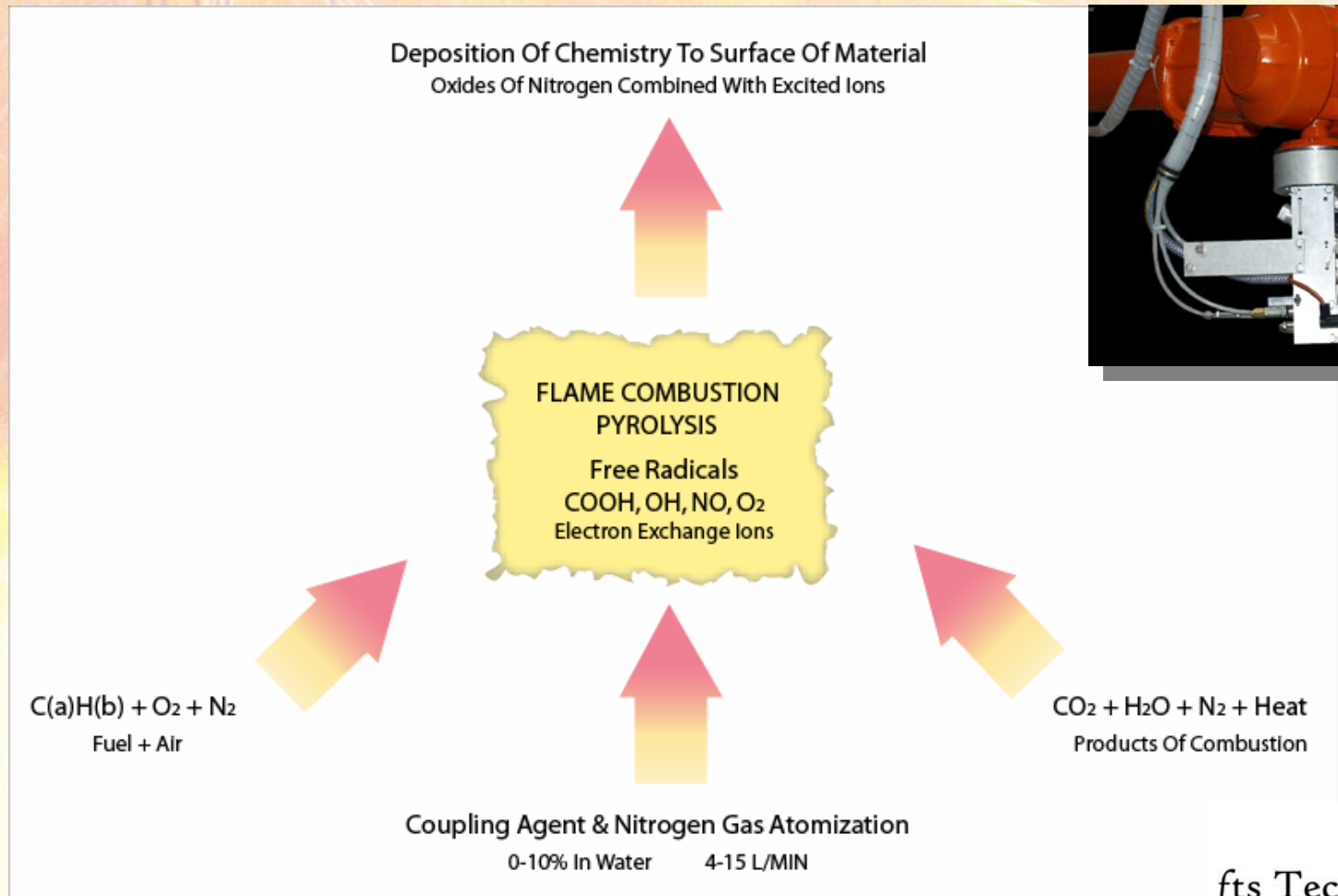
It Is A Cost-effective, Highly Durable And Environmentally Friendly Proven Process, Recognized And Accepted By A Number Of OEM's Globally

It is **NOT** Flame Treatment

**INNOVATION**

  
fts Technologies  
ATmaP™ Surface Treatment Technology

# ATmaP® Chemistry

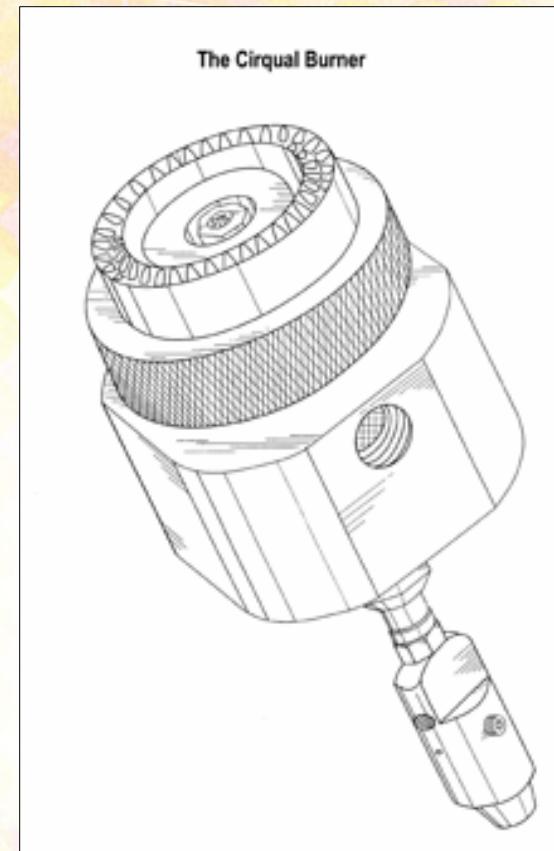


**INNOVATION**

**fts Technologies**  
ATmaP™ Surface Treatment Technology

# 'Cirqual®' Burner Technology

- Purpose
  - One Step Processing
- Functions
  - A Treatment Mechanism
  - Consistent Spray Delivery
  - Customizable Flame Shape
- Modular Construction
  - Easy to Remove/Replace Key Components



# Typical Automotive Applications

## ■ Treatable Materials with ATmaP® Technology Include

- TPO/PP
- Chrome
- Metal/Steel
- Rubber
- Composites
- Encased Structural Composites

### Interior Applications: (Bonding & Soft Touch Paint)

- Door Panels
- Instrument Panels
- Air Bag Covers
- Door Pillars
- Seat Covers
- Gaskets & Seals

### Exterior Applications: (Painting, Plating, Bonding, Laminating & Taping)

- Bumper Fascia
- Body Side Moldings
- Wheel Covers
- Grills (Painted & Chromed)
- Body Panels

Bonding of Suspension components

Structural Bonding of body panels

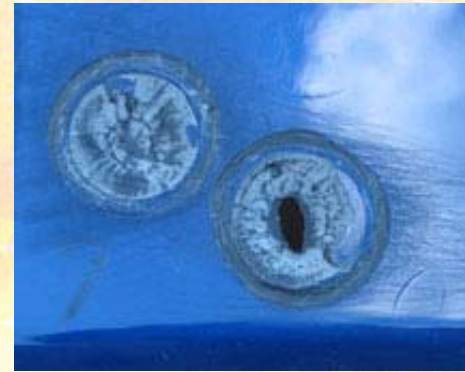
# Treating Variables

- Key Measurable
  - Oxygen Contents
  - Surface Velocities
  - Traverse Speeds
  
- Generation of Process Windows
  - Reactor & Compounded Materials
    - Definition
    - Flex modulus
    - Relationships
    - Key Variables
  
- Process Consistency



# Process and Enhanced Performance Characteristics

- Measurable and Consistent
- Surface Resistance
  - Permanent
- Robust and Durable
  - Improved adhesion to
  - High pressure water Jet
  - Gasoline resistance
  - Stone chip
- Proven Reduction in Warranty Claims
- LOW Capital Cost



Pull Strength Test



ADPRO System  
Gasoline Resistance

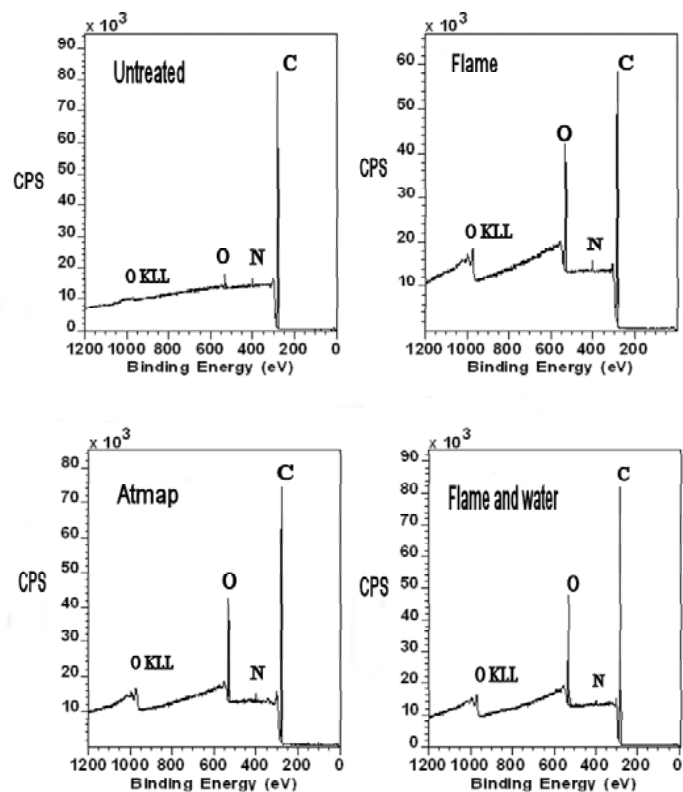


ATmaP System  
Gasoline Resistance

# Validation Of Treatment

- Generation of “key functional groups” on the surface of the treated material.
  - Compatibility with the coating to be used will provide consistent, robust, and repeatable adhesion.
  - Measurement of such is expensive and not very practical in production. Therefore other methods must be sought to act as a guide.

# XPS Data



SAMPLE	Z	Relative Atomic Concentration			
		C	O	N	Si
UNTREATED	Z	96.73	1.87	1.40	Z
FLAME	Z	86.70	12.70	0.60	Z
FLAME AND WATER	Z	86.35	12.57	1.07	Z
ATMAP	Z	84.24	13.01	2.12	0.63

# Measurement Of Treatment

- Measurement of Surface Energy
  - Dyne Inks
  - Static, Advancing, & Receding Angles
    - Advancing Angle Relates to Surface 'Wettability'
    - Receding Angle Directly Relates to Adhesion Quality

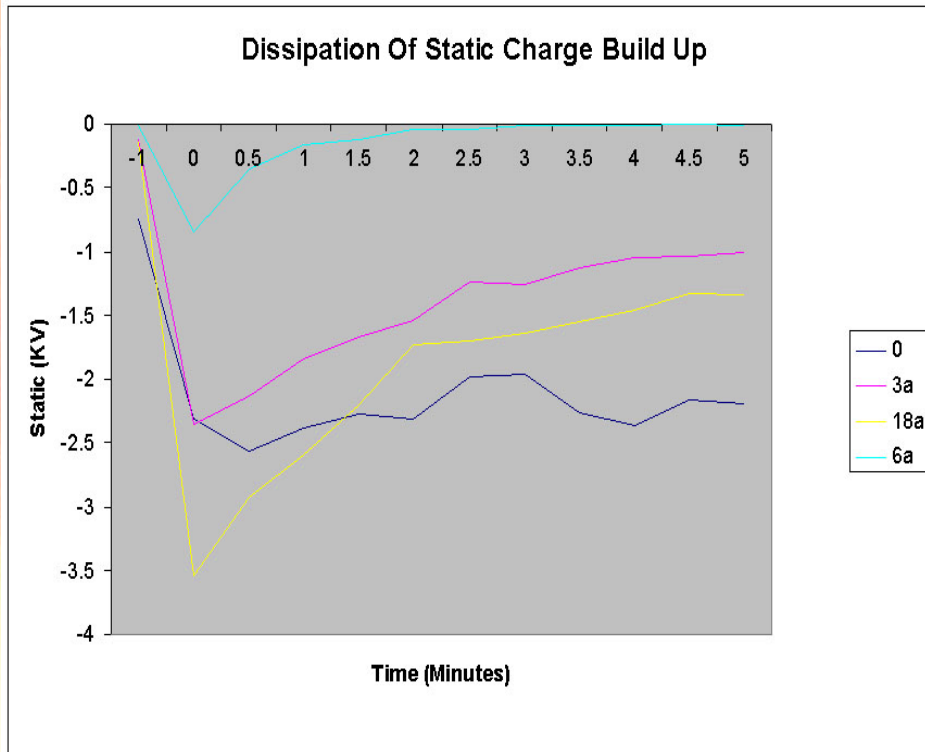
Plaque Type	Dyne Lev	Static Angle	Advancing Angle	Receding Angle
Untreated	<32	97° / 96°	97° / 96°	88° / 89°
Flame Treat	>56	70° / 69°	71° / 75°	28° / 25°
ATmaP®	n/a	39° / 60°	35° / 58°	16° / 10°

Results Show That ATmaP® Achieves 30%-60% Greater 'Wettability' and Adhesion to Polymeric Substrates

# Effects of Static Charges

- Paint line design is empirically a generator for static build up. Heating and cooling cycles, high air flows across a plastic combined with the introduction of a negative charge through electro-static's.
- Most TPO's do not have internal Anti-static agents which bloom to the surface providing dissipative qualities but potentially affecting adhesion.
- Applying External anti-static agents can compromise adhesion.
- Adhesion promoter is a conductor providing a path to ground but only effective where the path resistance is low and consistent with the part profile.
- Removal of conductive Adpro's from the paint system will allow building of a charge within the plastic and adversely affect TE.

# Dissipation Graphs



0: Untreated  
3a: Water with Base Chemical @ 10%  
6a: Water with Base Chemical @ 10% and Additive @ 10%  
18a: Flame Treatment Only

- Solvay 1718 TPO Material
- All Panels Subject To One Minute Exposure
- Electrostatic Gun Rated @ 36KVA
- All Panels Measure With Ground Strap Attached

# Application Variances and Transfer Efficiency

## Hyperprime

BC- 1x bell 500/30  
1x HVLP 500  
CC - 2x bell  
Wire frame  
No ground straps

## ATmaP

BC- 1x bell 500/30  
1x HVLP 500  
CC - 2x bell  
Wire frame  
No ground straps

## ATmaP

BC- 1x bell 500/30  
1x HVLP 500  
CC - 2x bell  
Mod Rack  
No ground straps

## ATmaP + Elect

BC- 1x bell 500/30  
1x HVLP 500  
CC - 2x bell  
Mod Rack  
No ground straps

## ATmaP + Elect

BC- 2x bell 280/38  
1x HVLP 500  
CC - 2x bell  
Mod Rack  
No ground straps

TOTAL FLUID USE

1000ml

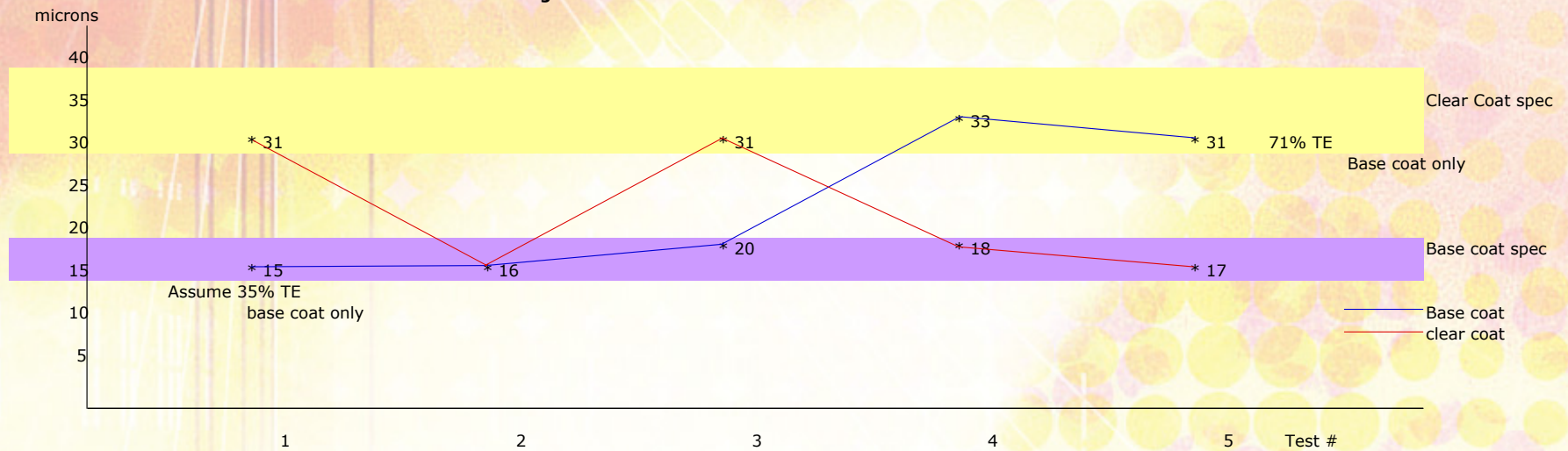
1000ml

1000ml

1000ml

1060ml

All data based on Averages



# The Environment - How we “Must” be better

## ‘Design for the Environment’

- Use Alternative Surface Treatments
- Elimination of VOC’s and HAP’s
- Reduce Energy Consumption and Emissions
- Reduce Manufacturing Cost
- Take Responsibility For Being A Good Corporate Citizen  
By Being Environmentally Conscious

# Environmental

- Lower Costs:
  - Lower Energy Usage Over Traditional Processes
  - Lower Emissions - Carbon Footprint
    - Significant Reduction in CO2 Emissions
    - No VOC's or HAP's produced
    - Environmental Credits
    - Can Be Fully Calculated Via Use Of Carbon Footprint Analysis (FTS)
- Zero Production of Solid Waste
  - No Clean Up Costs
  - No Disposal Costs
- Reduced Cost Of Compliance
- Reduced Risk Of Cost Of Non-Compliance

ATmaP Received A DaimlerChrysler "Environmental Leadership Award: Nov 2005

ATmaP Was Awarded A US EPA 'Clean Air Excellence Award': April 2006

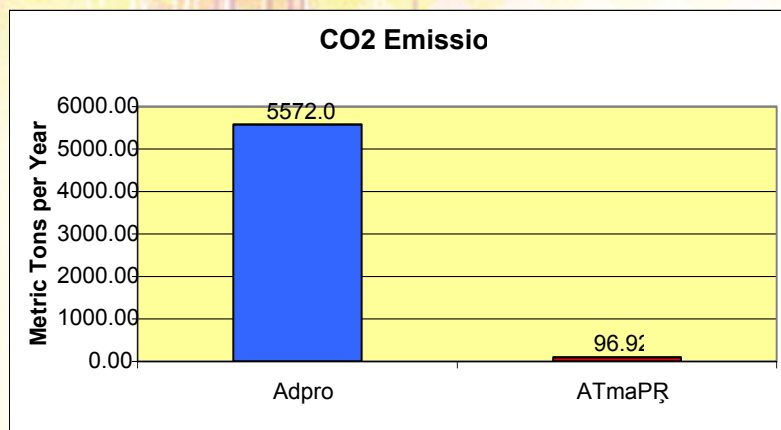


# CO<sub>2</sub> and Energy Comparison

SCFM	20,000
Efficiency Rating of RTO	40%
# of Annual Fascias	1,000,000

CO2 Emissions		
	Per Day (Metric Tons)	Per Year (Metric Tons)
Adpro	23.22	5572.06
ATmaP®	0.40	96.92
<b>Variance:</b>	<b>22.81</b>	<b>5475.14</b>

Natural Gas Amount Needed, and Cost Associated Over a One Year Period		
	CF/Year	Cost to Company
Adpro	66,708,369.41.	\$ 1,000,625.54
ATmaP®	1,160,378.95	\$ 17,405.68
<b>Variance</b>	<b>65,547,990.46</b>	<b>\$ 983,219.86</b>



Equivalent to gallons of gasoline used daily for process	
Adpro	2668.61
ATmaPR	46.42

Energy Cost Per Fascia		
Adpro	\$	1.00
ATmaPR	\$	0.02

Total Energy Savings		
\$	983,219.86	Annually

# Environmental Innovation: Success!

## ATmaP® Surface Treatment Technology

- United States EPA 'Clean Air Excellence' Award
- DaimlerChrysler 'Environmental Leadership' Award



- Suppliers Partnership For The Environment

# US & Worldwide Patents

- **ATmaP® (Accelerated Thermo Molecular Adhesion Process)**

*“Method And Apparatus For Treating Substrate Plastic Parts To Accept Paint Without Using Adhesion Promoters”*

United States Patent & Trademark Office # 6,582,773 B2  
# 6,716,484 B2  
New Zealand Patent # 528869  
Further Worldwide Patents Pending



- **Cirqual® Burner**

- United States Patent & Trademark Office # 6,796,793 B2  
Further Worldwide Patents Pending

**ATmaP® Is A Registered Trademark of FTS, LLC (Serial # 78/193734)**

**Cirqual® Is A Registered Trademark of FTS, LLC (Serial # 78/193738)**

# Thank you for your attention!!

## Acknowledgements

Jamie Brynolf  
Dr. Firas Awaja

FTS Technologies  
Deakin University

***Questions???***