

# TriStar



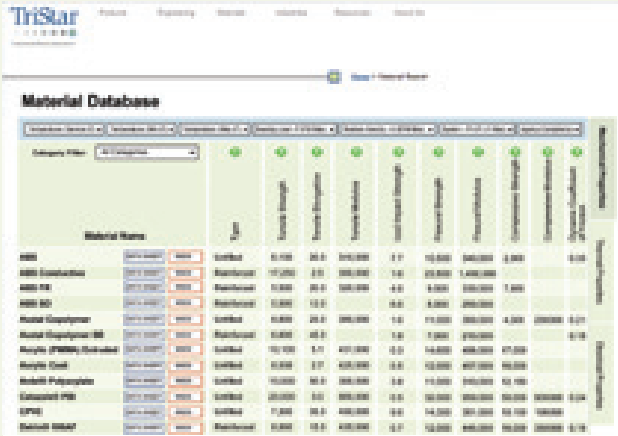
Engineered Plastic Solutions™



## Surface Modification



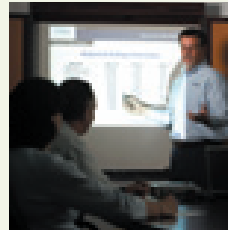
Engineering | Custom Fabrication | Manufacturing



Material Data

Our Material Database offers you the ability to instantly filter and compare thousands of the most popular high performance plastics in the industry based on your specific characteristics.

Filter, compare and call our engineering team to help you choose the right material and component geometry for your application.



Educational Seminars

We offer a series of Training Seminars on a variety of subjects relative to materials, component design and applications.

Custom seminars are available for your specific industry. Contact TriStar's technical department for more information.

High Performance Materials	Pushing the Design Envelope of Plastics
Plane Bearing Technology	The Application of Self Lubricating Materials in Bearings
Composites	Materials for Extreme Bearing and Structural Applications
Fluoropolymers	Specific Overview of Fluoropolymers and Their Applications

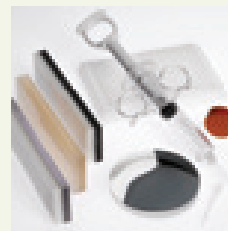


Analytical Services

We offer a complete array of surface analysis and materials characterization solutions by providing services that help companies get the critical information they need.

Our analytical techniques include:

- FTIR
- XPS
- AFM
- Goniometry
- Durometer [shore A shore D]
- Haze, Transmittance, Clarity [mainly transparent materials]
- Tensile Pull Testing [shear and T-peel]
- Compression Testing
- Flexural Testing



Surface Modification

From enhancing cell culture trays to bonding dissimilar materials, the scientists at TriStar's Surface Modification Division (SMD) can assist you in identifying problems and recommending solutions for your toughest surface issues.

Our expert technicians apply unique, dry, and environmentally-friendly techniques to modify the surface of polymers, elastomers, and films in order to dramatically increase [or, if desired, to decrease] the bond strength of adhesives, paint, markings, or specialty coatings.

Our services include:

- Surface Treatments
- Plasma Contract Services
- Custom Adhesive and Specialty Chemicals



tstar.com

Our site has been praised by engineers and purchasing agents alike. We continually strive to make this site an indispensable engineering resource for your company.

- Engineering Tools
- Ask The Expert
- Tech Talk Blog
- On-line Brochures
- Material Database
- Product Videos

With our in-house technical and scientific staff we can resolve any challenge and help you find the right engineered plastic solution.



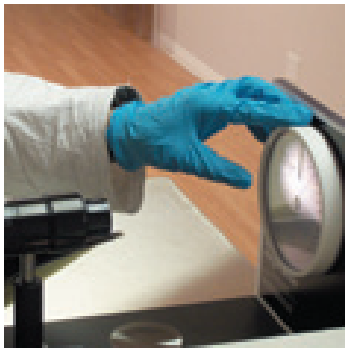
## Surface Modification

Our Surface Modification Service is just one more way that we are providing you with an advantage within your industry. This process can improve adhesion properties, micro-clean, functionalize (amine, hydroxyl, carboxyl, etc.), produce biocompatibility, create permanent wettability, and/or produce hydrophobic characteristics.

3

Some of the benefits include:

- Uniform 3-D Treatment
- Surface Chemistry Control
- Custom Adhesives
- Long Treatment Lifetime
- Roll to Roll Capability
- Specialty Chemicals



Materials that we modify include (but are not limited to):

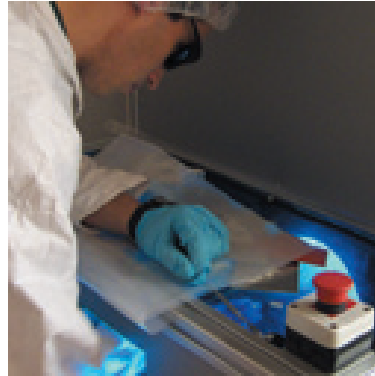
Acrylic	CR-39	Nylon 6 & 12	Polyester
Aluminum	Delrin	PeBax	Polyimide
Stainless Steel	Buna	EPDM	PEEK
Ceramic	Ethylene	PET	Polystyrene
Composites	Glass	Polycarbonate	PTFE [Teflon]
SBR	Urethanes	Silicone	Polypropylene



### Applications

- Adhesive bonding enhancement
- Improved decorative/industrial coating adhesion
- Modify wetting/non-wetting surface characteristics
- Enhanced metal cleaning
- Improved potting and overmolding
- Solventless PSA laminations
- Improved elastomer adhesion

## Common Surface Modification Applications



	<b>Application:</b>	<b>Problem:</b>	<b>Solution:</b>
	Polymeric well plates and cell culture trays	Polymer properties inhibit or interfere with reagents or cultures	Modification to enhance surface properties by grafting carboxyl, amine or hydroxyl groups.
	Molded polyurethane devices	Poor adhesion of paint, ink, glue or specialty coating	Modification to create a covalent bond between the polymer and the paint, ink, glue and/or coating.
	Marking (ink & paint) on devices	Polymer properties inhibit or interfere with marking adhesion	Modification to enhance surface properties by making substrate hydrophilic (wetable).
	Bonding dissimilar materials	Poor adhesion of paint, ink, glue or specialty coating	Modification to enhance surface chemistry allowing the materials to covalently bond without changing the bulk properties of the materials.
	Manufacturing of lenses and other optical devices	Poor adhesion and/or coverage of deposited films or coatings	Modification to enhance surface of a film for overmolding and/or modifying the surface energy of a lens prior to coating.
	Silicone "tack", "stickage", and/or "self-healing" properties	Sticky silicone parts clump together when packaged or self-heal after slitting, cutting or notching	Plasma processing can eliminate the "sticky" and "self healing" properties of silicone.
	PCB, flexible circuits, potting and/or encapsulation	Non-uniform anti-shock and anti-corrosion coatings and/or poor wire-bonds	Plasma cleaning to promote uniform and consistent coatings on an atomically clean surface.

## ■ Comparison of Surface Modification Techniques

The need to modify the surface of materials is a growing issue for many industries. Medical device manufacturers, biotechnology, diagnostic and some industrial companies are discovering the cost, manufacturing and yield benefits of surface modification equipment and services.

Plasma, corona, ozone and ultraviolet systems offer a novel approach to solving common surface treatment problems but one must choose the correct modification technique for their particular application. TriStar SMD offers an evaluation of our customer's product by looking at the polymer type, resultant process requirements, throughput demands, research and capital equipment budgets and project time lines. The result is a cost effective solution for the customer.

Surface modification can be accomplished using the following techniques:

### Plasma

Plasma is the fourth state of matter, a quasi-neutral cloud of ionized gas. Positive ions, negative ions, electrons and radicals in a concert of reactions and collisions as long as an electric potential exist. The vacuum plasma technique is very reactive and can readily prime any surface for adhesion, painting, coating/deposition or printing applications.

### Corona

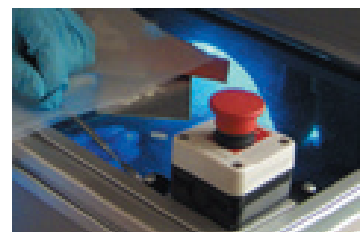
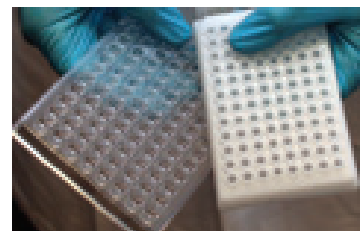
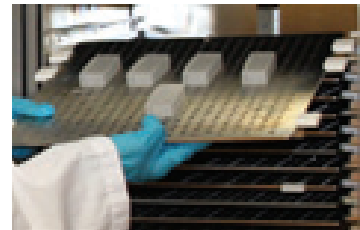
Corona discharge is plasma in atmospheric pressure. This plasma is produced by high voltage at the close proximity of two metal plates (electrodes) in atmosphere. When there is an electrical discharge in atmosphere, ions and ozone is nearly always generated. The ozone compound is relatively short lived and may disassociate to molecular oxygen ( $O_2$ ) and oxygen radical ( $O$ ). The oxygen radical is then free to work on the polymer or other molecules in the air.

### Photolysis

Photolysis systems operate on principles between plasma and corona. These systems use high voltage to excite a gas in an emitter which then radiates the surface of a polymer. The radiation is intense and fine tuned to chemically modify a polymer to be receptive to adhesives, paints, coatings and inks.

### Chemical

Many chemicals are used to prepare a surface for adhesion or coating systems. These types of systems are usually short lived but are easy to do without large capital outlays for equipment. Some polymers require special etchants that attack the molecular level of the polymer to expose carbon, especially fluorocarbon polymers.



## Pros and Cons of Surface Modification Techniques

### Plasma

**Pros** – The main advantage of plasma is that the surface chemistry is highly selective. Plasma systems control the treatment conditions by controlling the gas type, flow, pressure and concentration. Moreover, there is control over the energy frequency, wattage and electrode configuration. Plasma treatments offer a continuum of moieties and have the unique ability to treat a material three dimensionally. Plasma is also a green process with no hazardous bi-products resulting from the treatment process.

**Cons** – The main disadvantage to plasma is system price and throughput. The price of a system is relative to the size of the system. This is mainly due to the chamber size, pump and power requirements. TriStar SMD offers treatment services when system costs outweigh throughput demands.

### Corona

**Pros** – Corona systems are relatively inexpensive compared to plasma systems when product requirements demand in house processing. Corona systems are fairly robust and easy to maintain as well as easy to use. Using corona techniques should be considered on the basis of the polymer type being processed and the resulting surface condition requirements.

**Cons** – Corona processes are very short lived and the equipment should be used for in-line processing. Corona is best applied when the polymer is going directly from the corona discharge into a secondary process such as PSA application, coatings/inks, etc. Corona processes operate in atmosphere so they are as stable as the environment around them. It should be noted that corona is a two dimensional treatment only.

### Photolysis

**Pros** – Best used with stable polymers where high throughput is required. Materials such as nylon, EPDM, silicone, neoprene can be efficiently processed using this type of treatment. Cost of these systems is directly relative to the size of the equipment but can be made as simple hand feed systems or conveyORIZED for high volume needs. Photolysis systems are moderately priced and cost of operation is fairly low.

**Cons** – Photolysis offers very selective surface chemistry. Since it is a process done in atmospheric conditions it is not particularly stable so critical surface modification criteria can't normally be met. Photolysis is also a line of sight, or two dimensional, process so the shape and size of the product being treated is selective.

### Chemical

**Pros** – Chemical processes are simple and there is no particular requirement for capital equipment. With proper storage and handling chemical preparation of materials can be done in most work environments. Cost per application is fairly low as well.

**Cons** – Chemical solvents and etchants are very dangerous to handle and store. Disposal is also an issue with some of these products. Chemical processes are material specific as well so one solvent doesn't necessarily treat all polymers and elastomers. Fluorocarbon products are especially dangerous as the etching solutions are sodium based materials that are highly explosive and will burn if not handled properly. Chemical treatments should be at the users own risks.

TriStar SMD offers all of these treatments as service processes as well as the manufacturing of the equipment required for each process. Our Engineering staff will work with you to determine the proper treatment and work with you on evaluating your long term needs for equipment.

## Surface Treatments and Adhesion

Most polymers and elastomers need a pretreatment to improve the adhesion properties of the material's surface. This pretreatment is either plasma, corona, UV or chemical.

An area of expertise at TriStar SMD is the preparation of polymers or elastomers for optimum bonding to other materials using adhesives.

Identifying the proper surface modification process is based on understanding the specific application. Typical applications are the adhesion of paints, inks and even biomedical coatings to metals, polymers and elastomers. Moreover, our surface modification processes can de-tack elastomers for better handling, prepare elastomers to receive low friction coatings or improve hydrophobic or hydrophilic properties.

TriStar SMD can also assist in the selection of proper adhesives for your material to insure the best bonding possible. Our CE21 line of adhesives is a general purpose epoxy system with exceptional bond strength using any of the previously discussed surface treatments. Contact TriStar Engineering for more information.



## We work to meet your needs

### Custom and Rebuilt Plasma Systems

We have the experience and resources to either design and build you a custom system or reconfigure a used system to your specifications. If you have the need for an in-house system, but do not have the budget for a new tool, please allow us the opportunity to quote a custom or reconfigured system.

### Silane Coatings

If you have looked at other coating techniques and have decided that silane offers the most desirable surface characteristics, we are ready to work for you. Our experience and resources allow us to deposit a uniform and consistent coating to almost any material.

### Consulting and Seminars

TriStar's Surface Modification Division provides consulting and seminars at very reasonable prices. If you and/or your associates would like to learn more about the potential benefits that can be realized by using the technologies that we provide, please do not hesitate to contact us.

### Our Seminars are Structured to:

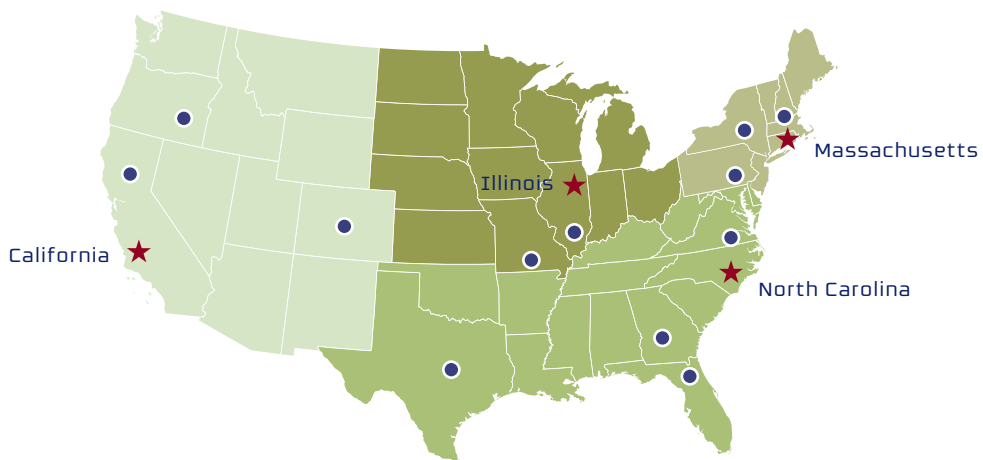
- Provide solutions to manufacturing problems
- Help groups in specialized industries
- Assistance with DOE work
- Save time and money in manufacturing
- Build value into your company's products

# TriStar



Engineered Plastic Solutions™

*The Advantage is closer than you think.*




[tstar.com](http://tstar.com) 1.800.874.7827



**PERFORMANCE PLASTICS**

Exclusive Rulon Partner



This company powered by:  **SYSPRO**

© 2011 Copyright TriStar Plastics Corp. Printed in U.S.A.