

Advanced Adhesives for Medical Applications



Polyolefin materials are increasingly used in the manufacture of medical devices, including surgical/steri-drapes.

For design engineers focusing on wound care, ostomy appliances, surgical drapes, and medical diagnostics, it becomes increasingly important to work with materials experts who can access a broad range of adhesives and materials to meet unique application requirements.

Different Materials and Adhesives

Among materials that are used in the manufacture of medical devices, there is a growing interest in polyolefins. This category of materials includes polystyrene, polycarbonate, acrylics, silicone rubber, polyethylene, polypropylene, and synthetic rubbers. Each material has its own benefits and limitations and must be carefully matched with the appropriate adhesive. For example, “non-stick” Low Surface Energy (LSE) plastics such as polyethylene and polypropylene require new adhesives specifically designed for strong bonding.

The primary types of adhesives used in medical device applications include:

- Acrylics
- Epoxies
- Styrene block co-polymers

Bonding, Joining & Sealing

Fast curing acrylics are available as one-part anaerobic adhesives that cure in the absence of oxygen, one-part light-cure adhesives that set up in seconds, and two-part formulations with improved viscosity and handling characteristics. Cyanoacrylates are also popular; they include one-part formulations that cure within seconds and are well-suited for joining LSE and other difficult to bond materials.

Epoxies are also used extensively, especially with film adhesives that can be die-cut to intricate custom shapes. These types of thin film bonding systems are a good choice when the bond line geometry presents a gap that must be filled. This is crucial in ostomy applications, where a strong seal is required to prevent leakage.



Adhesives for medical device applications include acrylics, epoxies, and styrene block co-polymers.

Advanced Adhesive Formulations

Whether used in wound care products or for adhering medical electrodes to skin, advanced adhesives are being created to improve stretchability, conformability, breathability, absorbency, porosity, and durability. New classes of adhesives with custom formulations include hydrocolloid, hydrophilic, and conductive adhesives. These adhesives provide kinder, gentler adherence to skin, with long lasting bonds for extended wear, and in some cases, the ability to withstand or absorb fluids. They have the following general properties:

- Nontoxicity
- Adhesion to organic and inorganic surfaces
- 100% solid before and after curing
- Optimized for wetting and gap filling
- Working characteristics suitable for high-volume production
- Compatibility with different forms of sterilization
- Anti-microbial characteristics

Hydrocolloids

Challenges for medical devices that require skin contact can often be reduced to a wrestling match between adhesion and irritation. Important factors include skin type, age, ethnicity, how often the dressing is changed, exposure to fluids, physical activity, and so on.

Hydrocolloid adhesives are the most “skin-friendly” alternative and are body fluid resistant. They represent a special type of pressure-sensitive adhesive with both fast adhering characteristics, as well as fluid absorbency. These adhesives have become key components in ostomy applications and wound dressings. Hydrocolloids are available in different formulations for different applications depending on the need for skin-friendly and absorbent properties. They can also be formulated for extended wear.

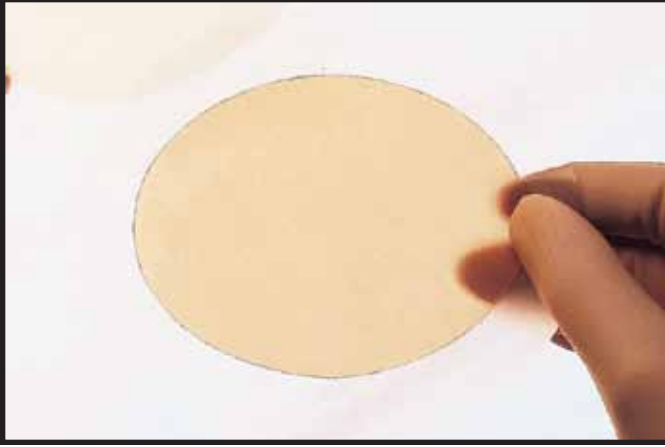
Important adhesive properties can include nontoxicity, as well as compatibility with different sterilization technologies.

Hydrocolloid adhesives can be applied to many substrate materials, including polyethylene foam, PVC foam, and polyurethane foam or film. Hydrocolloid tapes are available as single- or double-coated tapes. Double-coated tapes can have a hydrocolloid adhesive on one side to stick to skin, and an industrial strength adhesive on the other to adhere to another device, for example in a surgical drape application.

Since hydrocolloid tapes are custom formulations and applications, working with an adhesive and material expert is critical to achieve the exact formulation and combination required. Many new formulations make the hydrocolloids more suitable for a diverse range of materials, such as low surface energy (LSE) films or plastics, surgical drapes, foams, wovens, and non-wovens. Biocompatibility can be dramatically improved and the adhesives can better withstand autoclave, gamma, and ethylene oxide sterilization.

Applications for hydrocolloids include:

- Bordering and fenestration drapes
- Fixation tapes
- Incise films, including ophthalmic surgical incise films and drapes
- IV and catheter placement and secondary dressings
- Acute and chronic wound care
- Wound care that requires MVTR (moisture vapor transmission rate) and extended wear
- Medical device assemblies
- Antimicrobial wound care
- Ostomy applications
- Disposable electrodes
- Diagnostic equipment, including home healthcare equipment



Hydrocolloid adhesives are skin-friendly with fast adhering characteristics and fluid absorbency.

Hydrophilics

In addition to hydrocolloids, new work is being done with hydrophilic and hydrophobic tapes and films. These adhesives are moisture vapor permeable while also capable of providing a seal against liquid leakage.

Hydrophilic adhesives can also be formulated to allow for multiple reapplications without losing adhesive properties. Popular diagnostic applications for these tapes include:

- Blood glucose testing
- Blood coagulation monitoring
- Lateral flow diagnostic devices
- Microfluidic point-of-care testing

Electrically Conductive Adhesives

Adhesives that provide electrical conductivity are widely used in medical device applications that require high, sustained adhesion with no residue after removal. Applications include:

- Disposable ECG electrodes
- Grounding plates
- Electrode labels

Cold Seal Adhesives

Cold seal adhesives are widely used in packaging for wound dressing applications and are usually available in paper film, transparent plastic film, and transparent carrier film and paper combinations. Cold seals are also available with sealing forces ranging from low at 0.5 N/15 mm to higher at 4.0 N/15 mm.

Converters can deliver a range of die-cut capabilities, as well as expert advice in selecting materials and adhesives.

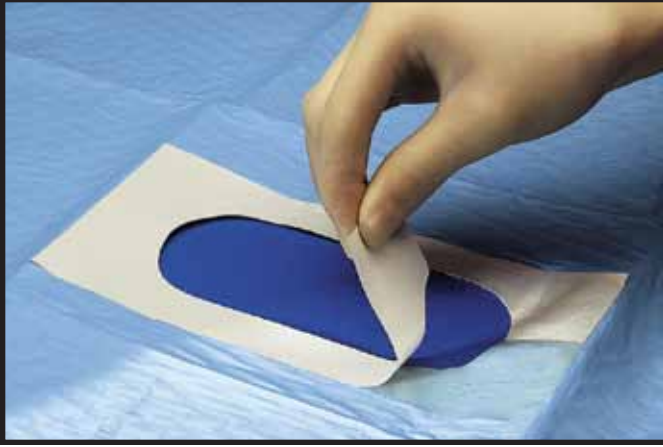
Cold Seal Advantages

Why use a cold seal product? Cold seal adhesives are a special type of pressure-sensitive adhesive (PSA) that forms a strong bond at room temperature with very slight pressure. Sometimes called cold seal, self-seal, or cohesive seals, they are applied to each of the substrates that will bond together. Cold seal adhesives bond only to themselves; they exhibit no tack to other substrates. As a result, they don't require a release liner. For some applications, this simplifies assembling materials within paper packaging, without damaging the contents.

The Role of The Converter

The importance of working with an experienced converter in the medical device industry, especially to take advantage of advanced adhesive capabilities, can't be overstated. Converters, such as Fabrico, deliver a range of die-cut capabilities, advice in selecting the most appropriate materials, and the ability to identify the best adhesive for the application.

Fabrico can select from servo driven rotary die-cutting, CNC die-cutting, laser die-cutting, water jet die-cutting, and die-less cutting (using a Zund machine), to meet the complex specifications of medical components. For complex foam tape die-cutting, water jet technology provides clean edges with no distortion. Laser die-cutting, kiss-cutting, slitting, and laminating can also be used in converting for medical applications.



Fabrico can die-cut surgical drapes and ostomy application components for almost any size or shape.

Fabrico custom converts:

- Diagnostic test strips and carrier frames;
- Composite wound-care dressings;
- Die-cut medical foam tape;
- Woven and non-woven biocompatible pressure-sensitive adhesive tapes;
- Surgical drapes and ostomy components.

In many instances, Fabrico provides label printing for tamper-evident and custom pressure-sensitive labeling of medical devices. Fabrico is also able to suggest the appropriate adhesive alternatives for a specific application, such as single- or double-coated tapes, the best liner for the application, whether a foam tape is well-suited for the application, and what might be available in hydrocolloid tape formulations.

An experienced converter can suggest adhesive alternatives for a specific application.

Material Partners

Fabrico has strategic relationships with world-class materials suppliers, such as 3M, Loctite®, and Adhesives Research to assist its customers in selecting the best material for the intended use and to expedite materials sourcing. Whether films or liquids, all critical material properties are considered in every Fabrico project, including chemical, thermal, and moisture resistance.

With more than 30 years of materials experience, Fabrico engineers also understand the impact of a material selection on the overall manufacturing process, and design material systems that optimize production efficiency and improve overall cost-effectiveness.

