



“The World of Adhesives and Sealants: Product Imagination: Innovation in Action”

TITLE SLIDE

The adhesives and sealants industry is committed to providing bonding and joining technologies through the use of innovative chemical technologies. Alternatives for joining substrates and components exist with various economic and performance tradeoffs depending on the choice chosen. They can be bolts, rivets, nails, fused and molded materials, welded, brazed, or soldered. In some cases, a product can be designed or made using chemical adhesives or sealants, with substantial benefit over alternate technologies. The purpose of this introduction is to help broaden your awareness of the important role our industry plays in everyday products spanning a wide variety of industries. While we may be limited by the technology, we are most often limited by our ability to imagine a solution.

“CONSIDER THIS” SLIDE

When you look around and see all the products that are used everyday, at home, at work, or anywhere else, you will quickly come to the realization that there are very few products out there that do NOT feature an adhesive or sealant in their design. Adhesives and sealants bestow untold advantages on a myriad of everyday products (and some not so everyday) that the average consumer takes for granted.

“IMAGINATION IS UNLIMITED” SLIDE

But sometimes the potential value of what adhesive and sealant suppliers bring to the marketplace is underestimated. The industry’s role is to think outside the box, encourage fresh new approaches to design issues, find REAL problems that require REAL solutions. Here are some examples:

Very shortly after he invented the telephone, Alexander Graham Bell made a statement that showed how much he underestimated the power of his own invention. Bell declared that, “Every

company throughout the whole of the United States of America will one day in the future own a telephone.” Mr. Bell’s prediction was eclipsed, however, by the chief engineer of the British Post Office who said in 1876, “This new telephonic apparatus may be well and good for our colonial cousins, but it will never catch on in Great Britain, as we have an adequate supply of messenger boys.”

In 1943, Thomas Watson, the Chairman of IBM offered this observation on the world’s future needs, “I think there is a world market for, maybe, five computers.”

And Microsoft co-founder Bill Gates probably still wishes he could pull back the words he uttered in 1981 predicting the future of computer memory by saying that “64K ought to be enough for anybody.”

Sadly, there are many examples of leaders in business and science today who are assuming that there’s little more to discover in chemistry, materials science and adhesives. That the industry itself is mature. . . that consolidation is the only possible route to success.

We must not only challenge such thinking, but refuse to accept it. Why? Because time and time again, the human race has achieved far more than it has anticipated. Creativity and innovation have repeatedly proven that we can achieve the unthinkable . . . imagine the possibilities, and then pursue them until they become reality.

Consider these examples:

- In 1899, as the 19th century turned into the 20th, most of the world’s advanced technologies were based on iron and steel. Adhesives in that time were based on animal proteins and natural rubbers primarily and surface preparation amounted to wiping dust off materials with your hand. In 1999, as we were turning the page to the 21st century, the world’s technologies were using nearly every element on the periodic table in one way or the other. Adhesives are now based on every imaginable technology and surface prep can be as simple as “not required” to plasma laser treatments.
- In 1900, many brilliant scientists were convinced that atoms existed; but just as many even doubted something like the atom could exist. It wasn’t until 1909 when Geiger and Rutherford proved the existence of the atom. Today, we are creating brand new

technologies by carefully aligning single atoms in strategic order, one at a time, until they form the adhesive with the exact characteristics we desire. The trick is to understand exactly what the customer does desire.

The speed with which new technology comes to market is no less dazzling. The time between a scientific discovery and to its embrace in the marketplace has been remarkably shortened. For instance, about 130 years transpired between the time the locomotive engine was first patented to when that invention was in common use. Eighty years went by between the invention of electric power and the time when 50 million customers were using it. In contrast, it took only 16 years for personal computers to find 50 million customers; 13 years for television sets, and only 4 years for the internet.

The *Washington Post* called this the 'whiplash progress of the 20th century' – tremendous invention at a dizzying pace, especially during the latter half of the century.

"We are a young species on a old planet," wrote Carl Suplee on the editorial page. "Homo sapiens have been around for only a few dozen millennia, and the basic model has barely evolved in a Darwinian sense. But the combination of relentless technological progress and social manipulation has made it possible to alter this creature's environment radically in intervals far shorter than a single lifetime.

"As a result, the physical and mental world we inhabit has changed more – and faster and more often – in the past 200 years than it did in the previous 20,000."

Believe it or not, the sentiments of the *Washington Post* are echoed by no less than the former President of the Peoples Republic of China, Jian Zemin. His country's civilization is accurately credited for four of the world's greatest inventions – paper, printing, the compass and gunpowder – each of which were significant enough to change world history. Yet Zemin and his successors today are pushing hard for the creation of a national innovation system for China. Zemin wanted to capture new ideas and accelerate their progress to the marketplace, because, as he said, "A knowledge economy and a sense of innovation are crucially important to our development in the 21st century."

The adhesive and sealant industry – one based on chemistry and materials science – has been responsible for, or played a key role, in most of the scientific breakthroughs one can name. And undoubtedly it will be an essential player for success in the remaining years of the 21st century as well. The maturing of the chemical industry will not be a hindrance to innovation. With the wide-open ability of science to hopscotch across every element on the periodic table, incredible computing power and the connectivity of the internet, there are limitless opportunities for innovation.

“WHAT IMPROVEMENTS” SLIDE

Therein lies the problem. The challenge for chemical innovators today is not in finding the answer, but in making choices among the limitless opportunities. In today’s faster-paced commercial environment, innovation comes from the pull for change in the marketplace. Consumer product life cycles have become incredibly short – which means we have to move that much faster to keep pace with quickly changing end markets. Consider these relatively mundane examples where adhesives have significantly changed the way a product is delivered, the way a product is used, or introduced a brand new product altogether.

“BABY DIAPER” SLIDE

These days, the disposable diaper is ubiquitous. Few mothers alive today even recall *their* mothers using anything but. And those handy diaper services of the mid-20th century? No where to be found. Adhesives play an integral role not only in the tapes but also the many layers of non-woven material which make of the diaper itself. And don’t forget everything used in the construction of the diaper must be ultra hypo-allergenic, not to mention able to withstand the rigors of a baby’s life!

“SELF ADHESIVE STAMP” SLIDE

Pressure sensitive adhesives are used a wide variety of products today include labels, decals and stamps. In the labels and decals area PSAs have revolutionized the way products are marketed on the shelf, think about the variety of colors and shapes of labels on your grocery store shelf today compared with just a few years ago when most labels were made of paper, were square and had very little color on them. Today’s labels are a myriad of colors made from a myriad of materials and advertising everything as well as providing much valuable use information for the product they are on.

Consider self adhesive stamps...this product didn't exist 10 years ago, now it dominates the postage stamp market. Why... because consumers found them easier to apply, they stay on the envelope better, there is no unpleasant taste when applying and it is possible to provide them in vending machines and ATMs, a feat not possible with lick and stick stamps.

“TOUCH PAD”, “CELL PHONE”, “SEMI-CONDUCTOR” SLIDES

As you move from buttons to touch sensitive keypads by using a combination of pressure sensitive adhesives and micro electronic circuitry you are able to make appliances smaller and sleeker or put more options in the same space. You can get more electronics into smaller spaces (very useful for airplanes and the space shuttle). And In fact you make products like Ipods and cell phones possible. Granted the adhesives are not the only innovation here, but they are real contributors to the possibilities developing in each of these markets.

“ATHLETIC WEAR” SLIDE

Athletic shoes demonstrate the versatility of adhesives which must provide for a flexible yet durable construction and must also be weather-resistant. The next time you hit the trails think of the form and function adhesives bring to your run.

“YOGURT LID”, “COFFEE BAG”, “CEREAL BOX”, “FROZEN PIZZA PACKAGE”, “SOFT DRINK BOTTLE”, “WINE BOTTLE”, “SHAMPOO BOTTLE” SLIDES

For packaging and laminating products adhesives are found in a wide variety of food and personal care products packaging applications including:

- Film to film, to foil, and to paper laminations for products like coffee where the package has moved from rather bulky metal cans to multi-layer bags that protect as well as the metal cans but take up less space both on the store shelf and in the homeowners shelf
- Carton sealing tapes that make the closure of cereal boxes more efficient and effective. Which becomes even more important as more of us move to shopping on the web and having our purchases delivered to us.
- Heat and cold seal adhesives that allow for fresh packaging of meats, cheese and ice cream as well as allowing products to move from the freezer to the microwave or to a boiling pot of water without changing the container.

- In packaging applications adhesives have created products that benefit the consumer by taking up less shelf space, by protecting fresh foods better and by providing greater flexibility to busy homeowners. These same adhesives have benefited the manufacturer of these products by giving them better shelf utilization as the packaging takes up less space, keep products fresher during shipment, increasing productivity by allowing them to package faster and lowering shipping costs since more product per unit pound is shipped.
- See-through labels, particularly on higher-end products such as fine wines and fancier shampoo bottles appeal to the eye and connote a more prestigious image,

“MICROWAVE POPCORN BAG” SLIDE

Consider the microwave popcorn bag...adhesives have played an integral role in how the product is delivered and involves some fairly high technology. As you may know, popcorn has been around since Columbus first discovered America. However, it was a snack that made a mess and was rarely eaten outside of movie theaters until the whole market was re-invented with the introduction of the gourmet microwave popcorn bags. Now, over 80% of the non-movie theater popcorn is bought in microwave bags and popcorn's share of the snack market has increased dramatically. And, the secret's in the bag.

First, in the bottom, under the inner layer of grease resistant paper, is a rectangle of metalized polyester. It reflects microwave energy back into the bag. Then there are the adhesives that hold everything together and seal the bag. Small heat activated vents in the seal release during the popping to allow steam to escape. Multiple adhesives holding foil to coated paper must resist hot oil, steam and pressure and yet not block transmission of heat into the bag to allow most the kernels to pop. That's a real engineering accomplishment!

“BLISTER PACK” SLIDE

Adhesives play an integral role in how blister packs are made, and help consumers be more assured of never missing a single dose.

“TRANSDERMAL PATCH” SLIDE

Adhesives provide an excellent balance of performance and price for most consumer medical applications. They can be tailored to meet the demands of gently adhering to skin and protecting a wound, under a variety of conditions. Certainly, the Band-Aid® is one of the most commonly recognized and established markets which tout the superior role of adhesives.

Consider the transdermal patch...where the drug delivery mechanism to the blood stream is through the skin. Adhesives enable a more efficient method of drug delivery rather than prescribing a high-ingestion dosage (which is subsequently flushed out of the body by the liver). The applications are many...smoke cessation, hormone replacement, and cardiovascular aid (I.e. nitroglycerin delivery) are commonplace. New transdermal patches hit the market every day with more items like pain cessation becoming a reality.

“TOOTH FILLING”, “BREATHE-RITE STRIPS”, “CATHETER”, “SYRINGE”, “HEARING AID” SLIDES

New advances in adhesives are resulting in exciting innovative products like topic skin adhesives (which aid in closing wounds with reduced scarring and patient discomfort), foot care and cosmetic patches, dental adhesives (including cavity fillings), nasal dilator strips, catheters, syringes and a myriad of other medical devices.

“WOOD PANELS”, “HOME CONSTRUCTION” SLIDES

Building construction represents another large market for adhesives and sealants. Today's environmental “green” movement demands more efficient homes that retain their energy, contribute to healthy indoor air quality, and can withstand the physical elements. Adhesives and sealants find use in a broad array of applications, ranging from the sub-floor to the roof and most everything in between. Window designs using structural sealant glazing (vs. conventional rubber gasketing) has literally redefined the look and feel of our cities with greater surface area made of glass.

“PASSENGER VEHICLE” SLIDE

Look at all the places adhesives and sealants can be used in automobiles and other vehicles.

Cured-in-place gaskets made with rubber to metal bonding adhesives:

- Reduce wind noise for critical NVH (noise vibration hardening) applications;
- Replace conventional cut gaskets;
- Increase overall vehicle quality.

Acoustical trim is just one example of adhesives and sealants in action. Black mats of asphalt-impregnated fibers are sandwiched between the sheet metal and upholstery on almost all current models from the U.S., Europe, and Japan – the result is a superbly quiet ride.

In terms of the manufacturing process, the pieces of trim must be applied in seconds with a light hand pressure, they must bond to steel coated with mill oil, and they must stay in place as other parts and panels are added and an exterior paint finish is heat cured. In addition, durability is critical – the bond must endure years of use in climates ranging from Arctic cold to sub-Saharan desert.

Adhesives are also used in weather stripping, decorative trim, and structural and non structural bonding with a variety of substrates in today's automobiles. As less of the auto is made of traditional metals and more is made of composites and other plastics, the role of adhesives is larger and larger in the automotive industry.

“WHAT IS YOUR INDUSTRY SITUATION” SLIDE

Imagine the possibilities this kind of insight could have, not only in electronics, but in many other industries as well! The ability to adjust or control material properties would allow industries to produce products with no waste; to diminish the use of natural resources, to create the exact product needed for the task at the appropriate cost – and widespread, judicious use of this science certainly would go a long way toward supporting the cause of sustainable development. Nanostructures could well become the instrument of progress early in the 21st century. And that's only the beginning.