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ABSTRACT

Individuals and businesses are implementing sustainability practices to help hinder the problems of air pollution and Global Warming. Packaging sustainability has increased its awareness since a third of all trash comes from packaging. Breit Technologies is a company that focuses on bringing innovative solutions to the printing industry. A environmental and economic solution developed by Breit for packaging sustainability is a decorative process called Cast & Cure (C²) that serves as an alternative to traditional holographic imaging techniques (ie. cold foil stamping, lamination, ect). C² allows for a decorative coating to be applied while maintaining the recyclability of the substrate. The process is cost effective, flexible and sustainable.

PACKAGING SUSTAINABILITY

Cast & Cure

According to the Environmental Protection Agency (EPA) each of us produce 4.4 pounds of waste each day, nearly doubled from 35 years ago. With the waste from America you could form a line of full garbage trucks and reach the moon. A third of this waste is estimated to be from packaging. In 2005, 164 billion pounds of packaging was sent to landfills and incinerators.

Sustainability Concerns

With all the consumption, natural resources are quickly being depleted and vast increases of carbon, methane, and other greenhouse gases in the atmosphere are causing Global Warming. Record growth in population, economy, urbanization, and energy use impose new stresses on the earth's resources and society's ability to maintain or improve environmental quality. Ways to improve the environment is to reduce your carbon footprint either by recycling or using processes that don't emit greenhouse gases.

As consumption increases, marketing becomes extremely competitive. Product differentiation is a key to capture the eye of the buyer. Using a decorative printing method is one way to gain attention for a product. Breit Technologies, founded in 2004, has developed with its partners, an environmentally friendly printing process known as Cast & Cure (C²). C² is a decorative printing method that creates a holographic effect using casting and curing techniques with UV coatings. Holographic images play with lighting to create eye-catching effects. The UV coating acts as a protector of the substrate making the packaging more durable. No greenhouse gases are emitted during the process, the casting film is reusable and recyclable, and the finished products can be recycled leaving an environmentally friendly product.

Sustainability

When it comes to packaging, "environmental friendliness" has now become "sustainability." There are several aspects that can be measured to determine a package's ultimate impact on the environment. The most common ones include source reduction, recyclability and carbon footprint (Demetrakakes).

Sustainability as defined by the World Commission on Environment and Development is a product that "meets the needs of the present without compromising the ability of future generations to meet their own needs." The idea of sustainability inspires public and private organizations to act as stewards of the environment. The goal of being sustainable is to improve our quality of life. To meet the standard of "sustainability" the materials must be same-cycled into a product of equal value or up-cycled into a product of greater value.

Packaging Sustainability

The biggest push for packaging sustainability is from the concern of air pollution and its impact on Global Warming (Demetrakakes). In order to hinder global warming the

emission of greenhouse gases must be reduced. Recycling packaging can reduce greenhouse gas emissions because fewer raw materials are used, less energy is required, and less fuel is used to transport and remove it.

A carbon footprint is a measure of the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, operation or service. It is meant to be useful for individuals and organizations to measure their personal impact in contributing to global warming. Carbon emissions enter the environment either directly from the burning of fossil fuels, or indirectly from the generation of electricity.

Greenhouse gases are the gases present in the atmosphere, which reduce the loss of heat into space and therefore contribute to global temperatures through the greenhouse effect. An excess of greenhouse gases contribute to Global Warming which can have an effect on the environment causing weather related problems in return increasing economic and health problems.

Carbon Footprint Reduction

Reducing your carbon footprint directly improves the environment by lowering the emission of greenhouse gases that contribute to Global Warming. One way to reduce your carbon footprint is by decreasing volatile organic compounds (VOC's), which are gases emitted from certain solids or liquids that damage the ozone layer. Solvents used in products such as coatings, inks, adhesives, and consumer products, are generally classified as VOC's. VOC's themselves do not raise health concerns, however, they react with oxides of nitrogen (a by-product of fossil fuel combustion) in the presence of heat and sunlight to form ground-level ozone-the main contributor of "smog." Under the federal Clean Air Act they are regulated as "ozone precursors."

In order to reduce ozone levels, federal and state agencies have developed regulations to reduce VOC emissions from a variety of sources, including products that contain solvents. In some cases, such as major coating operations, regulations impose the installation of a control device such as an incinerator or solvent recovery system. By controlling hazardous air pollutants (HAP's) you can protect the environment as well. The EPA and state governments regulate 187 chemicals and chemical categories that are deemed hazardous.

Creating regulations on packaging is another way to sustain the environment. 28 countries around the world have packaging mandates in place to encourage reduced packaging and recyclability. Currently in the U.S. there are no federal packaging mandates, but many companies have started to implement their own standards. The EPA recommends that packaging be made more sustainable to serve as good stewards of the environment. This means

- Eliminating toxic constituents
- Using less material
- Making packaging more reusable
- Using more recycled content
- Making it more readily recyclable

Initiatives Taken by Industries on Sustainability

Today you can see a drive to sustainability as large companies place regulations on producing and selling products that are environmentally sustainable. Wal-Mart has set up benchmarks, along with Target and P&G. The consumer demand of “green” goods is being reflected in producer and retailer’s goals to deliver what the consumer wants. In the end, production has the greatest effect on the consumers and demand is showing they are extremely supportive of a clean and healthy environment.

Wal-Mart is one of the leaders in the industry that has received a lot of attention for its ambitious proposal to reduce its environmental footprint. Lee Scott, CEO of Wal-Mart, states: “If we throw it away, we had to buy it first. So we pay twice-once to get it, once to have it taken away. What if we reverse that? What if our suppliers send us less, and everything they send us has value as a recycled product? No waste, and we get paid instead.” Wal-Mart is fully aware that going “green” can be extremely profitable, just by bundling for resale the plastic that it used to send to landfills or incinerators, the company saved \$28 million a year (Hirshberg).

Wal-Mart’s two company-wide goals are to create zero waste and to sell environmentally friendly products (“Wal-Mart”). They know that being an efficient and profitable business and being good stewards of the environment are goals that can work together. Wal-Mart’s new slogan, “Save Money. Live Better.” shows just how serious they are (Bony).

On Good Morning America, Andrew Shapiro, CEO of Green Order, said: “Wal-Mart is not only saying we’re going to do good ourselves, but we are going to require the people that sell through our stores change how they do business.” Wal-Mart has already begun to build a greener business and is encouraging its suppliers to do the same by innovating and designing more sustainable products (Bony). Breit Technologies offers a solution for designers that are looking to attract the customer’s attention while maintaining the recyclability of a product with the Cast and Cure process.

Wal-Mart estimates 92 percent of its environmental footprint is embedded mainly in the products the company sells. Suppliers are highly encouraged to follow suit on sustainability because Wal-Mart accounts for a high percentage of their sales, even if that means re-designing their wares and packaging so they’re less hazardous, use fewer resources, and create less waste (Bony). In November of 2006 Wal-Mart introduced a sustainable packing scorecard that evaluates suppliers on their progress of developing more sustainable packaging (“Wal-Mart”).

The scorecard evaluates Wal-Mart and Sam’s Club suppliers on their progress in developing more sustainable packaging, and helps track Wal-Mart’s progress to reduce packaging in its supply chain by 5 percent by 2013. The scorecard can be used to show how supplier’s product packaging helps Wal-Mart achieve their goal to be supplied by 100 percent renewable energy, create zero waste and sell sustainable products (“Wal-

Mart”). This has caused an increased interest in Breit Technologies Cast and Cure process which meets the specification set forth by Wal-Mart’s score card.

The main goal of the Packaging Sustainable Value Network is to be packaging neutral by 2025, which means all packaging recovered or recycled at their stores and Clubs will be equal to the amount of packaging used by the products on their shelves. Wal-Mart will only carry products that are packaged with materials safe for human and ecological health (“Wal-Mart”).

To reach that goal the products and packages must meet “The Seven R’s of Sustainable Packaging (“How”).”

1. **Remove.** Eliminate unnecessary packaging, extra boxes or layers
2. **Reduce.** “Right size” packaging, use fewer or lighter components
3. **Reuse.** Use post-consumer recycled material (PCR), reusable plastics
4. **Renew.** Use material made from renewable resources
5. **Recycle.** Recycled, recyclable, compostable materials
6. **Revenue.** Achieve the above for the same or lower cost
7. **Read.** Print recycled/recyclable message on packaging

Many of the seven R’s are met using the process of Cast and Cure compared to traditional processes. C² has eliminated the use of a transfer material and the film used in the process is reusable up to 12 times. This innovative process is also a fraction of the cost of similar decorative methods already on the market. The application is environmentally conscious, helping printers meet the demand for “green” processes and production of packing that is more environmentally friendly.

Wal-Mart has estimated that altogether its suppliers will save \$11 billion/yr by using less paper and plastic and by using more eco-friendly materials. It projects its own operations will save about \$3.4 billion/yr through packaging reduction, according to the trade publication Promo Magazine, a Renton Media publication.

Target, another environmentally conscious company, is a founding member of the Sustainable Packaging Coalition (SPC) a leading and highly respected organization in this emerging field. Target has focused on understanding how their packaging needs can meet sustainability requirements (“Sustainable”).

In 2006 Target created a team to give recommendations about sustainable choices or whether reduction in packaging was beneficial. Target looks for opportunities to source packaging material that are:

- Recyclable
- Made with recycled content
- Biodegradable or bio-compostable
- Made with renewable resources
- Manufactured using renewable energy or using less nonrenewable energy

- Source from companies practicing responsible harvesting

Target has implemented regulations for the top sheet of all private label corrugated packaging to contain 90 percent post-consumer recycled content. 66 percent of total paper stock used at Target in-house printing facility is recycled paper (“Sustainable”).

Proctor and Gamble has set sustainability goals to improve the environmental profile of their products. Their goal by 2012 is to develop and market at least \$20 billion in cumulative sales of “sustainable innovation products,” that are products with less than 10 percent environmental footprint versus previous or alternative products. P&G embraces the idea of sustainable development as a business opportunity and responsibility to the environment. The Cast and Cure process matches P&G’s initiatives for reducing their carbon footprint.

Since 1990, P&G’s focus on pollution prevention has resulted in a 60 percent reduction in waste as well as air and water emissions per unit of production in manufacturing plants. Sustainability is a concept that P&G has incorporated into its day-to-day business decision.

Industries have begun to recognize the need of sustainability and are joining in with or creating new standards of production. Packaging sustainability is an idea that is implemented from the conceptualization of a product to its disposal. Many companies throughout the production are setting their own standards of sustainability from designers and producers all the way to retailers and buyers.

Sustainability Organizations

There are several organizations measuring, developing and discovering ways to help the packaging industry meet the needs of sustainability. These organizations are committed to the goal of developing ways to maintain or improve the state of the environment.

GreenBlue is a nonprofit institute that focuses on redesigning industries by creating practical solutions, resources and opportunities for applying sustainability. Sustainable Packaging Coalition (SPC) is a project of GreenBlue that serves the packaging community. SPC is an organization dedicated to finding solutions to transform the packaging industry into a system that encourages economic prosperity and a sustainable flow of materials.

SPC’s approach on sustainability is to share best practices and design guidelines, support innovative and effective new technologies, and provide education in regard to the environment. “The Sustainable Packaging Coalition envisions a world where all packaging is sourced responsibly, designed to be effective and safe throughout its life cycle, meets market criteria for performance and cost, is made entirely using renewable energy and, once used, is recycled efficiently to provide a valuable resource for subsequent generation.”

Dow Jones Sustainability Index (DJSI) launched in 1999 introduced the first global indexes tracking the financial performance of the leading sustainability-driven companies worldwide (“Launch”). In regard to the index, Scott Stark said: “Being proactive and innovative with regard to future sustainability challenges is increasingly regarded as a crucial success factor and, thus, as a significant lever to increase long-term shareholder value. A rising number of asset managers therefore seek to invest in sustainability leaders.”

Breit Technologies LLC has introduced the innovative Cast and Cure process to the market as an alternative decorative printing method that is sustainable and cost effective. Producers are able to create an eye catching effect while maintaining the recyclability of substrates.

A growing concern for a cleaner environment is going to be business’s top priority as consumption continues to increase. Sustainability organizations are leading the way to the future by measuring and developing ideas on how to protect the environment. Eventually practices implemented by the industry might make their way into laws.

CAST & CURE (C²)

Reduce, Reuse, & Recycle

Cast & Cure (C²)

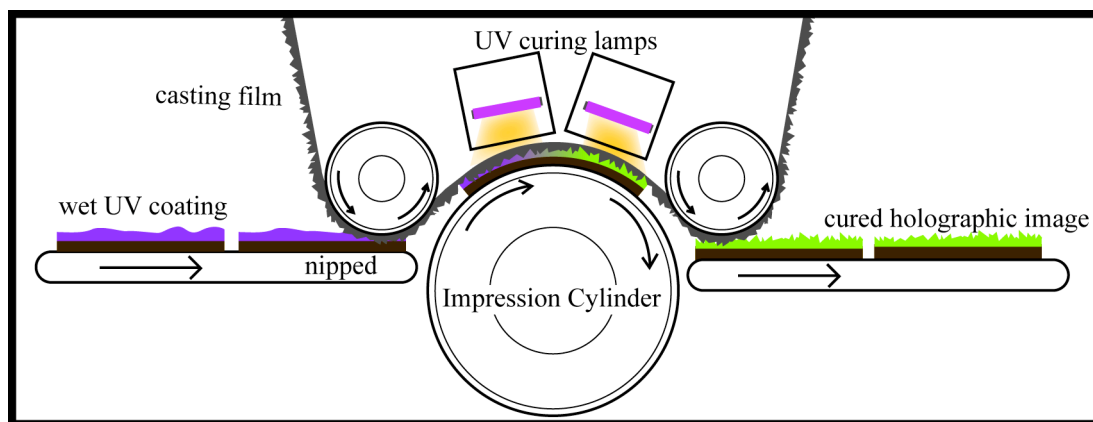
Cast & Cure (C²) is a decorative coating process that integrates “casting” and “curing” techniques to form a consistent high quality surface that can include ultra high gloss, matte and holographic finishes on a variety of substrates. This effect can be created in both sheet fed and web (flexo and gravure) environments. C² is an excellent application for the decorative print market and can be incorporated with anti-counterfeiting features.

The Cast & Cure process is “green” on many fronts. The reusability of the film is beneficial in that you can avoid the “one-to-one” achieved with traditional lamination and create a “many-to-one” scenario. The film itself is also recyclable.

C² uses ultraviolet (UV) and electronic beam (EB), energy curable coatings and varnishes, which are solvent-free. The use of UV and EB materials eliminate the undesirable and harmful VOC’s found with many traditional decorating processes. It can also make packages more recyclable by elimination of the laminated metallized films used in traditional holographic processes. The most significant benefit is this is all achieved at a fraction of traditional cost.

Many standards and sustainability goals set by companies are met through the Cast and Cure process from reduction in use of natural resources to the recyclability of packaging.

Cast & Cure Process



UV Technologies

Reductions of VOC and greenhouse gas emissions go hand in hand with UV technologies, according to a position paper released by RadTech-The Association for UV and EB Technology. “The U.S. Environmental Protection Agency and local air quality Districts recognize UV and EB as environmentally proactive,” says David Harbourne, RadTech President and President of Fusion UV Systems, Inc. There are no Hazardous

Air Pollutants in UV-cured inks and coatings that appear on the EPA’s list of regulated HAP’s (Jones).

“In one study by a major U.S. manufacturer, UV offered over 65 percent reduction in greenhouse gas emissions—the study also found an 80 percent reduction in the total amount of energy used by the facility’s process, compared to a conventional system” (“Greenhouse”). “The use of UV/EB curing processes can reduce greenhouse gas emissions by reducing reliance on the burning of fossil fuels,” says Mr. Harbourne. “Companies that adopt UV/EB processes are at the forefront of greenhouse gas and pollution prevention in general, as the technology can meet, or exceed any mandated emission reductions.”

UV-cured printed or coated products have always been recyclable for a lower-grade paper such as board for folding paper boxes, roofing paper, or cellulose insulation. This type of recycling can be classified as “down-cycling.” More recently there have been dramatic improvements in “up-cycling” of UV-cured paper (Jones).

Paper companies have adopted new technologies for recycling paper. With the traditional recycling of washing and screening, UV coated paper was not easily “up-cycled.” With the introduction of floatation cells into the recycling process, UV-cured material can be “up-cycled” more easily (Jones).

In a study commissioned by RadTech to Beloit Corp., fiber systems division, in 1992, found UV coated paper can be recycled into tissue and fine paper grades using commercially available equipment (Korn).

Advantages of Cast & Cure

The Cast & Cure process provides many distinct advantages to other processes.

- Environmentally Friendly- no VOC’s and full recyclability of product
- Surface is un-affected by humidity variation
- Consistent Surface Appearance (No Orange Peel)
- Good Rub Resistance
- Anti-counterfeit features
- Lower Coating Consumption
- Less Energy Consumption

Printing

The Cast and Cure equipment is available in a variety of formats for a variety of printing processes.

| | |
|-------------------|-------------------|
| <i>Sheet Fed</i> | Litho and Gravure |
| <i>Wide Web</i> | Flexo and Gravure |
| <i>Narrow Web</i> | Flexo |

Equipment Capabilities

- 10,000 Sheet/Hour maximum speed
- 30X40 maximum sheet size
- Film saving function

- Quick and Easy Material Handling Device
- Automatic Shim Skipping and Multiple Pattern Film feature.
- Wide Range of Material (80-400g/M2)
- Traditional and Non-Stop delivery options

Substrates Cast & Cure Can be Applied to

- Paper and Paper Boards
- Pressure Sensitive
- Metallized Substrates
- Laminated Materials
- Films and Plastics

Security

The Cast & Cure process can be a cornerstone or compliment to a security program for brand protection and identification.

- Custom Holographic Designs
- Registered Holographic Effects for Target Areas
- Custom Build Security Programs

Applications

- Commercial Printing and Publications
- Packaging
- Books and Magazines
- Tamper Evident Outer Packaging

Cast & Cure Film Legal and Safe Use

The C² film is sold exclusively thru BREIT Technologies LLC to ensure authentic product and performance results. Licensees are available for use of material as well as the process. There are no safety concerns when using the Cast & Cure film.

CAST & CURE CASE STUDY

Cold Foil Stamping

Foil Stamping uses a polyester film, typically with a metallic look. The process does not use harsh or toxic chemicals in the manufacturing process, but since the foils do not break down in the recycling-process the paper is more difficult to recycle and ultimately the foil carrier end up in the landfill.

Lamination

There are 2 types of lamination process: film and liquid. The liquid laminate finish is applied much like a varnish or coating and dried in much the same way. With the film technique, paper is sealed between 2 thin layers of plastic film, the edges sealed with adhesive, and dried with heat. Volatile organic compounds are emitted during the lamination processes. The paper is un-recyclable since plastics are bonded with the substrate.




The lamination process uses a variety of solvent products that have a direct negative environmental impact with the emission of VOC's.

Cast & Cure (C²)

Cast & Cure creates a holographic image using a casting film and UV curing system on a substrate that is UV coated. The process eliminates the use of solvents by using a UV coating and utilizes multiple uses from the casting film that is recyclable. Cast & Cure also maintains the recyclability of all products that it is applied.

Cold Foil, Lamination, and Cast & Cure all produce a decorative effect that can enhance the look of a product. C² does not transfer a material or use a metallized layer, but it still creates a decorative effect on the printed piece, see Table 1.

Table 1
Difference Between Cold Foil, Lamination, and Cast & Cure

| | Material Transfer | Formation | Metallized Layer | Type of Varnish | Illustration of Layers |
|----------------|-------------------|-----------|------------------|-----------------|---|
| Cold Foil | YES | YES | YES | ADHESIVE |  |
| Lamination | YES | YES | EITHER | ADHESIVE |  |
| C ² | NO | YES | NO | COATING |  |

Predictable Application

A toothpaste company sends a design for toothpaste boxes to a printer for production and they chose to apply a flood coverage decorative effect. The run is going to be 32,270 sheets of 40" x 28" 12 pt. cover paperboard. If they choose cold foil 14,171 lbs. of product is produced and for lamination 14,310 lbs. is produced. Papers with applied lamination or foil are not fully recyclable so potentially they will end up in landfills. Whereas, if the designer choose the decorative process of Cast & Cure which produces a similar effect, 13,009 lbs. would be recyclable reducing the impact of landfills. See table 2.

**Table 2
Weight of Materials in Finished Product**

| | Weight of Paper | Weight of UV Coating or Adhesive | Weight of Transfer Material | Total Weight |
|----------------------|------------------------|---|------------------------------------|---------------------|
| Cold Foil | 12,779 lbs | 230 lbs | 1,162 lbs | 14,171 lbs |
| Lamination | 12,779 lbs | 230 lbs | 1,301 lbs | 14,310 lbs |
| C² | 12,779 lbs | 230 lbs | 0 lbs | 13,009 lbs |

Finished Product Non-recyclable
Finished Product recyclable
See appendix for calculations.

With the use of Cold Foil and Lamination film you are averaging a 10% weight increase onto the substrate, which in turn will consume more energy in transportation increasing the amount of CO² into the atmosphere contributing to Global Warming.

When compared to other processes, Cast & Cure produces a positive impact on Global Warming because it maintains the recyclability of the product. The environment benefits from recycling and reuse because it creates less demand for raw materials. Traditional processes demand more natural resources with the addition of the transfer material that can be used only once.

As businesses continue to develop and implement new standards for packaging, recyclability of products and packaging will become extremely important. More attention will be drawn to reducing the environmental footprint of packaging since it's a large percentage of landfill waste. Products will always come with a package, but how that package is designed and produced will change. Presently, the packaging industry is focusing their energy on how to protect the environment for future generations by reducing, reusing, and recycling.

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APPENDIX

Materials Used

| | Calculation | | Total Amount |
|---------------------|----------------------------|---|--------------------|
| Paper Area | .72 sm x 32,270 sheets | ≅ | 23,234.4sm |
| Paper weight | .55 lbs/sm x 23,234.4 sm | ≅ | 12,779 lbs. |
| UV Coating | .0099 lbs/sm x 23,234.4 sm | ≅ | 230 lbs. |
| Foil | .05 lbs/sm x 23,234.4 sm | ≅ | 1,162 lbs. |
| Lamination | .056 X 23,234.4 sm | ≅ | 1,301 lbs. |

The calculations are based on a run of 32,270 sheets that are 40" x 28".

The information and specifications used to calculate the totals can be found below.

Conversion factors used in Calculations

1m≅3.28ft

1gram≅.0022 lbs

Paper

12pt = 250gsm

250gsm ≅ .55 lbs/sm

Information obtained from: www.starprintbrokers.com/paper.html

UV Coating

4.5gsm ≅ .0099 lbs/sm

Information obtained from: Breit Technologies LLC

Foil

25" x 1,000' ≅ 10 lbs

.05 lbs/sm

Information obtained from: www.infinityfoils.com

Lamination

27" x 250' ≅ 2.95 lbs

3mil

.056 lbs/sm

Information obtained from: Coastal Business Supplies Inc. Quoted on June 25, 2008 called 1-800-562-7760. Website www.coastalbusiness.com/index.asp