

Dynamics of Sublimation Printing

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ABSTRACT

In scientific terms, Sublimation is the transition of a substance directly from a solid-state to a gas state. It does not pass through the usual liquid state, and only occurs at specific temperatures and pressures. It's a general term that is used to describe the solid-to-gas transition and refers to the physical change in state only. It has a specific process of printing that first involves printing onto a special sheet of paper, then transferring that image onto another material. The ink is then heated until it disintegrates into the fabric. The aim of this paper is to present scientific research method of sublimation printing process.

KEYWORDS: Sublimation, Transmission, Heat Press, Printing Technology

INTRODUCTION

Sublimation printing is a digital printing technology that enables the reproduction of various customized and personalized color prints/ images to various specially coated surfaces including plastics, films, woods, textiles, ceramics, metals etc. In sublimation printing process, the solid printing dye is sublimated into a gas at high temperatures and is exposed to the surface to be printed. The gas thus formed penetrates the polymeric surface, creating permanent bonds with it.

This process gives high resolution and permanent coloration to the exposed surface, which is highly resistive to peeling and cracking off surface of the material. Due to this, sublimation printing is increasingly being utilized across various industries to give highly durable, aesthetic and distinct prints on various kinds of products such as mugs, fashion wear and sportswear, technical textile, ceramic tiles and others.

Dye sublimation printing is known for providing high-quality photographic results. It has become a popular method of printing on suitable materials. One of the significant factors that are found to be attractive about dye sublimation printing is that it

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directly goes from solid stage to gas without entering the liquid phase. Sublimation transfer paper in dye sublimation printing utilizes heat to initiate the conversion and pressure to control it. The result obtained is a permanent, good quality print that won't fade, peel, crack, or wash away with time. The urge to provide better quality characteristics led to innovations which enabled dye sublimation printing on both fabrics and rigid materials. They are better than the conventionally used other printers in terms of graphics quality and the speed of printing. Hard items like ceramics and metals would require a particular type of coating to accept the dye sublimation printing inks. The dye sublimation printing technique requires two things –

1. Special transfer paper for printing graphics using sublimation inks
2. Heat press to transfer the image from special transfer paper to the item you want

Certain other factors are also essential while choosing the sublimation paper like ink capacity, print speed, and others. Rapid growth in the digital textile market will contribute to the growth of dye sublimation printing market. The outlook for growth of the global

dye sublimation printing market is therefore expected to be positive during the forecast period.

Literature Review

- Sublimation transfer printing of polyester is a well established technique. For successful transfer printing of PET/cotton blends, however, it is necessary to provide a suitable pretreatment to impart disperse dye affinity to the cotton component. This paper reports attempts to synthesize a crosslinking agent based on the reaction product of melamine formaldehyde/polyethylene glycol 200. The fabric was treated with this product by pad-dry application; curing and transfer printing were simultaneous. The performance of the synthesized product in terms of dye transfer, wash and light fastness, and its effect on physical properties of the transfer printed fabric was compared with the commercial melamine formaldehyde resin. (R. B. Chavan, M. Hanif Langer January 1, 1988).
- Attempts have been made to standardize the conditions for the cyanoethylation of cotton to get a high degree of substitution (DS). Under standardized conditions, nitrogen content of as high as 10.5% corresponding to the DS 2.04 was obtained. The behaviour of cyanoethylated cotton during sublimation transfer printing with disperse dyes was also studied. Good prints with satisfactory wash-and light-fastness were obtained on cyanoethylated cotton with DS 1.5. (Chavan, R B et al. (1987).
- This study deals with the effect of dye-sublimation printing on the performance of underwear. Two groups of polyester knitted fabrics were analysed. The change of three selected groups of properties was investigated before and after the application of dye-sublimation printing, namely durability (breaking force and elongation, abrasion resistance and pilling resistance), physiological properties (water vapour permeability, air permeability) and color-fastness (resistance to rubbing, to domestic and commercial laundering, to perspiration). Further, the structure changes of fabrics (thickness and density) during heat pressing both without application of dyes (without transfer printing on material) and with application of dyes were also studied to analyze the affect extent of printing conditions (particularly pressure and temperature) on total wear comfort printed fabrics. The results show that the tested materials meet requirements in terms of color-fastness to rubbing, to domestic and commercial laundering and to perspiration to a very high standard (grade 5). In terms of abrasion resistance and pilling resistance the material also showed high resistance. The air permeability for both fabrics decreased by about 40% in comparison with the value obtained before printing and the mechanical properties slightly increased (about 8%). This was due to an increase in the stitch density and a decrease in the thickness, therefore reducing the porosity of the material for printing. (Viera Glombikova and Petra Komarkova, 2014).
- The influence of sublimation transfer printing on alteration of the structural and physical properties of knitted fabrics was investigated in this research study. Seven different knitted fabrics, which differed in terms of structure and raw material composition (polyester, cotton and cotton/polyester), were printed using the sublimation transfer technique. For the sublimation of cotton/polyester and cotton knitted fabrics, a coating powder was used for paper modification with the aim to bond reactive ink to the natural fibres. The influence of yarn parameters, pattern and the density of knitted fabrics on the degree of changes after the printing process was considered. Smaller changes in structural and physical properties were recorded for polyester knitted fabrics, while major changes in structure were observed in knitted fabrics containing cotton fibres, where were weight gain and reduction in geometrical roughness values. In addition, a significant change in density was recorded for polyester printed knitted fabrics. The parameters that influenced the colour difference results for polyester knitted fabrics were the yarn parameters and the pattern. Significantly high colour difference values were obtained for cotton (from 7.9 to 14.2) and cotton/polyester (from 8.5 to 14.4) knitted fabrics. The main reason for the high colour difference results was the alteration in the structure of the knitted fabrics. (Meral ÖZOMAY, Zafer ÖZOMAY, 2020).
- A significant proportion of graphic design output is printed by ink jet onto textiles as brand promotion, on garments and as “soft” signage. Designs are printed either directly with sublimating inks onto polyester or indirectly using a transfer method onto a range of fiber types. Printing by transfer onto textiles was one of first methods of accessing “print-on-demand” and print engineering, printing textiles only as and where they are needed rather than to stockpile, and is now one of the key advantages of ink jet printing. An early adopter of wide-format ink jet printing for textiles, this section will discuss this

distinct market segment and its predominant technologies. (Christina Cie, 2015)

Objective

1. To introduce methodology of sublimation printing by use of heat press machine.
2. To highlight the importance of sublimation printing in world of digital printing
3. To briefly explain techniques of sublimation printing, market scope

Methodology

The report is a compilation of first-hand information, qualitative and quantitative assessment by industry analysts, inputs from industry experts, and industry participants across the value chain. The report provides an in-depth analysis of parent market trends, macroeconomic indicators and governing factors, along with market attractiveness within the segments. The report also maps the qualitative impact of various market factors on market segments and various geographies.

Dye Sublimation Printing Market – Dynamics

Dye sublimation printing has broad applications ranging from fashion to soft signage. It utilizes heat sensitive inks for printing. The dye sublimation printing market is anticipated to witness an upright growth because of its multiple applications in various industries. Mainly used in textile printing, and the increased population will directly influence its market growth. Polymer treated materials available in the market, which includes aluminum, plastic, glass, hardboard sheet materials, and others can be used for dye sublimation printing. Dye sublimation printing is considered eco-friendly due to –

1. Minimum waste of dye as it does not go through the liquid phase
2. It could be used multiple times to print more than once

The dynamic photographic results obtained by dye sublimation printing would be responsible for the rise in dye sublimation printing market. A few downsides to dye sublimation printing are

1. The choice of material available is limited
2. Requires polymer based surface
3. They aren't the most eco-friendly options out in the market
4. An expensive method because the pieces of equipment are quite costly

This could lead to the slow growth of the respective market. In the coming years, dye sublimation printing could be used in decorating packaging materials, which could be an easy way to advertise any product creatively. Packaging materials act as the first point

of contact at stores as they can be used for advertisement.

Dye Sublimation Printing Market – Segmentation

Segmentation of dye sublimation printing market

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On the basis of types of heat press, the global dye sublimation printing market has been segmented into–

1. Small format heat press
2. Calendar heat press
3. Flatbed heat press
4. 3D vacuum heat press

On the basis of application, the global dye sublimation printing market has been segmented into –

1. Interior decoration
2. Textiles & apparels
3. Promotional items
4. Signages
5. Awards & Photo gifts

Dye Sublimation Printing Market – Regional outlook

Europe has played a significant role in the development of dye sublimation printing in the textile industry. The Asia Pacific has and continues to contribute to be the key market in dye sublimation printing. The increase in the demand for textiles will also contribute to the growth of dye sublimation printing market globally.

Dye Sublimation Printing Market – Key players

1. Seiko Epson Corporation
2. MTEX NS, S.A.
3. Negi Sign Systems & Supplies Co.
4. Roland DGA Corporation
5. Sawgrass Inc.
6. Mitsubishi Electric Corporation
7. HP Development Company, L.P.

This study by TMR is all-encompassing framework of the dynamics of the market. It mainly comprises critical assessment of consumers' or customers' journeys, current and emerging avenues, and strategic framework to enable CXOs take effective decisions.

Our key underpinning is the 4-Quadrant Framework EIRS that offers detailed visualization of four elements:

- Customer Experience Maps
- Insights and Tools based on data-driven research
- Actionable Results to meet all the business priorities
- Strategic Frameworks to boost the growth journey

The study strives to evaluate the current and future growth prospects, untapped avenues, factors shaping their revenue potential, and demand and consumption

patterns in the global market by breaking it into region-wise assessment.

The following regional segments are covered comprehensively:

- North America
- Asia Pacific
- Europe
- Latin America
- The Middle East and Africa

The EIRS quadrant framework in the report sums up our wide spectrum of data-driven research and advisory for CXOs to help them make better decisions for their businesses and stay as leaders.

Below is a snapshot of these quadrants.

1. Customer Experience Map

The study offers an in-depth assessment of various customers' journeys pertinent to the market and its segments. It offers various customer impressions about the products and service use. The analysis takes a closer look at their pain points and fears across various customer touch points. The consultation and business intelligence solutions will help interested stakeholders, including CXOs, define customer experience maps tailored to their needs. This will help them aim at boosting customer engagement with their brands.

2. Insights and Tools

The various insights in the study are based on elaborate cycles of primary and secondary research the analysts engage with during the course of research. The analysts and expert advisors at TMR adopt industry-wide, quantitative customer insights tools and market projection methodologies to arrive at results, which makes them reliable. The study not just offers estimations and projections, but also an uncluttered evaluation of these figures on the market dynamics. These insights merge data-driven research framework with qualitative consultations for business owners, CXOs, policy makers, and investors. The insights will also help their customers overcome their fears.

3. Actionable Results

The findings presented in this study by TMR are an indispensable guide for meeting all business priorities, including mission-critical ones. The results when implemented have shown tangible benefits to business stakeholders and industry entities to boost their performance. The results are tailored to fit the individual strategic framework. The study also illustrates some of the recent case studies on solving various problems by companies they faced in their consolidation journey.

4. Strategic Frameworks

The study equips businesses and anyone interested in the market to frame broad strategic frameworks. This has become more important than ever, given the current uncertainty due to COVID-19. The study deliberates on consultations to overcome various such past disruptions and foresees new ones to boost the preparedness. The frameworks help businesses plan their strategic alignments for recovery from such disruptive trends. Further, analysts at TMR helps you break down the complex scenario and bring resiliency in uncertain times.

The report sheds light on various aspects and answers pertinent questions on the market. Some of the important ones are:

1. What can be the best investment choices for venturing into new product and service lines?
2. What value propositions should businesses aim at while making new research and development funding?
3. Which regulations will be most helpful for stakeholders to boost their supply chain network?
4. Which regions might see the demand maturing in certain segments in near future?
5. What are the some of the best cost optimization strategies with vendors that some well-entrenched players have gained success with?
6. Which are the key perspectives that the C-suite are leveraging to move businesses to new growth trajectory?
7. Which government regulations might challenge the status of key regional markets?
8. How will the emerging political and economic scenario affect opportunities in key growth areas?
9. What are some of the value-grab opportunities in various segments?
10. What will be the barrier to entry for new players in the market?

With a robust experience in creating exceptional market reports, Transparency Market Research has emerged as one of the trusted market research companies among a large number of stakeholders and CXOs. Every report at Transparency Market Research goes through rigorous research activity in every aspect. The researchers at TMR keep a close watch on the market and extract beneficial growth-boosting points. These points help the stakeholders to strategize their business plans accordingly.

TMR researchers conduct exhaustive qualitative and quantitative research. This research involves taking inputs from the experts in the market, focused attention on recent developments, and others. This method of research makes TMR stand out from other market research firms.

Here's how Transparency Market Research helps the stakeholders and CXOs through the reports:

Inculcation and Evaluation of Strategic Collaborations: The TMR researchers analyze recent strategic activities like mergers, acquisitions, partnerships, collaborations, and joint ventures. All the information is compiled and included in the report.

Perfect Market Size Estimations: The report analyzes the demographics, growth potential, and capability of the market through the forecast period. This factor leads to the estimation of the market size and also provides an outline about how the market will retrieve growth during the assessment period.

Investment Research: The report focuses on the ongoing and upcoming investment opportunities across a particular market. These developments make the stakeholders aware of the current investment scenario across the market.

Note: Although care has been taken to maintain the highest levels of accuracy in TMR's reports, recent market/vendor-specific changes may take time to reflect in the analysis.

Conclusion

Many scientific papers have dealt with the topic of heat transfer printing or dye-sublimation printing and have tested the quality of printing and researched the dye used. However, it is also necessary to look at the changes in the properties of the fabric (linked to the structure) which have been dye-sublimation printed. It is assumed that the changes in the fabric due to dye sublimation printing are induced by the following parameters: temperature, dwell time and pressure. These changes are reflected especially regarding comfort (air permeability, water vapor permeability) and durability (strength, elongation, thickness).

Report highlights:

- Detailed overview of parent market
- Changing market dynamics in the industry
- In-depth market segmentation
- Historical, current and projected market size in terms of volume and value
- Recent industry trends and developments
- Competitive landscape
- Strategies of key players and products offered
- Potential and niche segments, geographical regions exhibiting promising growth
- A neutral perspective on market performance
- Must-have information for market players to sustain and enhance their market footprint

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