JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

The Study of the screen printing

AMITA KHANDZODE, Nikhila Rane

Msc. Student PG Dept. Of Textile Science and Apparel Design, Asst.prof.P.G.Dept of Textile Science and Apparel Design

SNDT Women's University, Mumbai

Abstract

As screen printing can create excellent prints on a variety of substrates, it is a flexible printing method that is utilised extensively in many different industries. The relationship between substrate surface properties and screen printing quality is studied in this review paper. Factors such substrate texture, porosity, surface energy, ink type, and printing parameters are investigated through a thorough examination of the body of literature currently in publication. Discussed are the research's ramifications for the electronics, textile, and packaging industries, along with areas that could use more study and implementation. Through comprehension of the nuances of screen printing on various media, this review seeks to further improvements in print quality and workflow efficiency.

Keywords: screen printing,ink, screen.

Introduction

The printing process originated in mediaeval Asia, according to certain historians. This is due to the stencil printmaking technique, which involves projecting a design onto a screen and covering any blank space with an impervious material. Afterwards, ink is pushed through the mesh holes by pressing the screen up against the material. A comparable method was first documented in the Chinese Song Dynasty (960–1279 AD), and in the late fifteenth century, missionaries and adventurers carried it to Europe.Initially, the lack of fine silk screens in Europe prevented the technology from being employed as widely. Additionally, Europe lacked lucrative market niches. Nonetheless, stencil-based painting techniques have been applied to artwork and typography in numerous nations worldwide.[2] screen printing can be used to print on a variety of materials, including technical textiles, leather goods, home furnishings, textiles for clothing and shoes, and decorative textiles. They are used simultaneously in the automotive, electronics, medical, and aviation industries.[2]

Simple hand tools like a table, screen frame, and squeegee are used for a lot of manual screen printing. All commercial screen printing, however, is done on power-operated presses; these include roll-fed and beam (EB) curing inks, which are used for coatings and other specific applications. The ink and energy consumption of EB curing are lower than those of UV curing, but the hardware is more expensive; hence, there may be more applications for these inks in the future. In addition to colour and colour strength, the most crucial aspects of inks are their body, length, tack, and drying characteristics, all of which differ across these and other varieties. These qualities, referred to as theological variables, need to be tailored to the procedure and the paper being used.[5] Screen printing is a popular technique in the growing field of textile printing, which is a significant aspect of the

modern graphic industry. Numerous factors, including the kind of substrate material and printing ink used, affect print quality. An objective evaluation of the printed image's colour and tone is the standard method for determining print quality. Print quality is undoubtedly impacted by quality criteria including contrast, sharpness, and macro-uniformity, which are not related to colour reproduction.[4] In the printing industry, paper is still the most widely used substrate, but polymeric substrates are increasingly popular. The density of polar functional groups is lower in commercially accessible polymers, such as the surfaces of polyethylene terephthalate (PET), polyvinyl chloride (PVC), and polypropylene (PP). As such, these materials have low adhesive properties by nature. It is now difficult to produce a high-quality print on these polymer substrates. Therefore, for such surfaces, surface modification has become essential.(4)

Types of mesh for screen printing

1. The ideal mesh count for a very heavy deposit, the quality of the outline is not important Under 45-110 inches (18-43cm)
2. Heavy deposit, good definition 110–195 inch (43 – 77 cm)
3. Thin deposit, extra-fine detail, and fine lines 195–355 inches (77 -140cm) [6]

Printing inks

PLASTISOL INK

Plastisol ink is typically used by those who screen print. It offers crisp graphic detail and is thick, strong, and adaptable. Additionally, plastisol ink is readily available, long-lasting, easy to mix, and compatible with a broad variety of screen printing tools, designs, and techniques. It also comes in a large spectrum of colours. It also doesn't dry out after being on the screen for extended periods of time. This kind of ink works well with softer prints because of its low viscosity and high density, which prevents it from arching. It also offers a flat, low-gloss finish. To dry, Plastisol ink requires heat.

WATER-BASED INK

Water-based ink is preferred by some because it absorbs into the cloth instead of sitting on top of it like Plastisol does. When compared to screen prints created using Plastisol ink, this results in a softer feel. It also gives some people's prints a more substantial feel. Furthermore, even printers with little experience or expertise can easily employ water-based inks. However, in humid situations, it may take longer to dry and may need to be heated. Since this kind of ink is semi-transparent, bespoke colour matching could be necessary to get a consistent appearance throughout the garment.

DISCHARGE INK

There are two forms of discharge ink: water-based and Plastisol. When discharge ink is used, the pigment of the ink replaces the colour of the cloth in the regions where it is applied. Because of this, discharge ink is a well-liked option for users of 100% cotton. Fabrics silk screened using discharge ink require the use of a heat source to thoroughly cure the ink. It does take a considerable amount of skill to use this kind of ink.

METEALLIC PLASTISOL INK

Metallic inks give prints a bright, metallic appearance by suspending metallic flakes within a plastisol-based ink. As a result, the ink is extremely glossy and thick. Because of the nature of the ink, we advise against using artwork with a lot of fine detail because printing metallic inks requires a very low mesh screen, which makes it very

difficult to produce fine detail in the print. In order to print the ink thick enough to provide the appropriate metallic sheen, a screen built with a lower mesh count than other inks must be used.[8]

COLOUR

Only four (4) ink colors—Cyan, Magenta, Yellow, and Black—are needed to produce full-color printing. These four ink colours are overlaid in different concentrations to create full-colour graphics, and they are collectively referred to as CMYK.The CMYK printing method Is sometimes referred to as 4-colour printing since it uses four ink colours. Therefore, 4/4 denotes that CMYK's four ink colours are used to print on both a sheet's face (also known as side one) and reverse (also known as side two). Otherwise, full-colour printing is present on both sides.Therefore, we can write "4/4" or say "Four over Four" instead of having to write or say, "Side one is to have 4-Colour CMYK printing, and side two is also to have 4-Colour CMYK printing."[9]

The ability to transfer materials with a wide range of functional qualities at high thickness and firm loading makes screen-printing the most popular process in printed electronics. Screen printing research, however, is still deeply entrenched in the graphical age, with little knowledge of the basic science underlying the ink transfer mechanism. This prompted the adoption of a comprehensive strategy covering every stage of the creation of printed electronics, from ink formulation to screen printing and post-processing. With an emphasis on carbon inks because of their low cost, electrical conductivity, inertness, and functionalization or modification potential. According to parametric experiments, ink rheology did not affect the amount of ink deposition caused by blade squeegees; instead, lower angles and softer blades increased ink deposition.[10] A variety of carbon-based concentrations are accessible in screen-printable carbon-based inks, leading to a diversity of rheological characteristics. When using high-loading and high-elasticity functional inks, it can be difficult to get a nice print; functionality and printability frequently need to be traded off.[11]

Factors Affecting Screen Printing quality.

1. Silk Screen

The screen has a direct Impact on printing quality; its properties dictate moire, printing accuracy, dot size, and dot shape. When printing, the right screen must be selected based on the printing specifications.The most widely used meshes for screen printing are nylon and polyester. Other typical meshes include silk, nylon, polyester, and stainless steel. The two primary parameters used to assess the overall quality of screen material are screen tension and screen surface roughness. These variables have an impact on the fine line and image detail, particularly the ink deposition. In general, a coarser mesh screen results in a thicker ink layer; a finer mesh will result in a thinner ink layer and poor shading.

2.Scraping Board

A scraping board Is also known as a scraper, and it is primarily used to transfer ink from the screen surface to the substrate surface in order to apply pressure.Although the construction of the scraping board is straightforward, the printing products' quality is highly significant, thus it is necessary to use the right scraping board in accordance with various printing needs.The blade's shape, hardness, and width are the three primary characteristics of the scraper board.

Although knife faces come in a variety of shapes, the flat, square knife is the most widely utilised.If there are any concave or convex missing angles on the knife surface, the printing pattern will be harmed. Instead, the surface must be flat and straight.

3.Screen

The primary indicator that influences printing quality is screen thickness. Screen thickness must be selected reasonably since too thin of a screen will result in a jagged edge that will cause uneven printing of text and text edge, and too thick of a screen will impair the print resistance.Furthermore, the photosensitive adhesive coating on the screen surface needs to be consistent. A smoother screen is better suited for screen printing, as it facilitates the efficient transfer and transmission of graphic information.

4.printing inks

Mostly from the ink's fineness, fluidity, and viscosity, as well as other factors that affect print quality when it comes to screen printing ink. If the ink dries on the plate too quickly, it can impact the imprinting consistency, viscosity and even create blocking. If the ink dries too slowly, it can also raise the cost of drying or slow down production. The optimal drying ink typically dries quickly on the substrate and slowly on the plate. This type of performance is exhibited by photosolid, thermal solid, and thermal printing cold solid inks.[1]

First, select the materials for screen printing and printing, such as the mesh, colour, printing qualities, and frame and wire mesh materials.

Second, the deployment of the screen printing set's equipment and tooling, such as the screen printing machine and positioning tools,

Third, the manufacturing process involves the creation of screen plates, stretch nets, printing, etc.

Fourth, the environmental factors related to screen printing: the temperature, humidity, and cleanliness of the screen printing field—particularly the latter—have a significant impact on the quantity of product [3]

Characteristics of screen printing

- A variety of substrates can be printed on with screen printing.
- It is feasible to print on substrates of different sizes and forms using screen printing.
- You can get a wide variety of ink.
- It is feasible to cover it thickly. (Special stencil: greater than 100 microns; general stencil: 10–30 microns)
- Colours are more vibrant, finishes are more opaque, and lightfastness is improved with thick coatings.
- It is feasible to print on delicate materials because of the low printing pressure.
- Because the stencil is pliable, it may be used to print on both soft and hard surfaces, including paper and textiles, as well as metal and glass.
- One benefit when producing in small quantities is the stencil's low cost.[14]

Conclusion

In conclusion, the surface that will be printed on has a big impact on the quality of screen printing. This study has shown that many surface properties, including composition, texture, and porosity, are important in influencing the final print quality. Comprehending these variables facilitates customised printing procedures, which enhance print excellence, longevity, and general client contentment. Furthermore, improvements in ink formulas and surface treatment methods present chances to improve screen printing quality even more on a variety of substrates.

This study emphasises how crucial it is to take surface characteristics into account when optimising screen printing procedures for a variety of applications, including electronics and textiles.

Reference

1) Analysis of factors affecting screen printing quality Riley GeorgeApr , (2020)https://www.linkedin.com/pulse/analysis-factors-affecting-screen-printing-quality-riley-george
2) Angerer , S.(2022). Screen printing, going stronger than ever. https://www.fespa.com/en/news-media/screen-printing-going-stronger-than-ever

3)FIVE FACTORS AFFECTING THE ACCURACY OF SCREEN PRINTING.

https://www.macrokun.com/News/screen-printing-mesh-news/338.html

4)Hendeniya,N.Attygalle,D.(2021).Atmospheric Cold Plasma to Improve Printability of Polyethylene Terephthalate. Moratuwa Engineering Research Conference (MERCon)https://www.researchgate.net/publication/354588987_Atmospheric_Cold_Plasma_to_Improve_Printability_of_Polyethylene_Terephthalate

5)Handbook on Printing Technology (Offset, Flexo, Gravure, Screen, Digital,30.Asia Pacific Business Press Iac.

https://books.google.co.in/books?id=UdXFDwAAQBAJ&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

6) Meseldžija,M. (et.al).THE ANALYSIS OF THE SUBSTRATE INFLUENCE ON THE PRINT QUALITY PARAMETERS OF SCREEN-PRINTED TEXTILE.VIII INTERNATIONAL CONFERENCE OF SOCIAL AND TECHNOLOGICAL DEVELOPMENT. https://scholar.google.com/scholar?start=10&q=+screen+printing+quality+depending+on+the+surface+to+be+printed.&hl=hi&as_sdt=0,5#d=gs_qabs&t=1711055138398&u=%23p%3Dis0YSo7lQgwJ

7)Olusegun,A.(2023) Screen Printing Mesh Count

https://www.screenprintingnow.com/equipment/screen-printing-mesh-count/

8) Potts,S.(2020).Advanced Manufacture by Screen Printing .Thesis Submitted to Swansea University in fulfilment of the requirements for the Degree of Engineering Doctorate.College of Engineering, Swansea University.

https://www.researchgate.net/publication/357871643_Advanced_Manufacture_by_Screen_Printing

9)Potts,S.(2020).The Effect of Carbon Ink Rheology on Ink Separation Mechanisms in Screen-Printing·

https://www.researchgate.net/publication/346337425_The_Effect_of_Carbon_Ink_Rheology_on_Ink_Separation_Mechanisms_in_Screen-Printing

10)Screen Printing Ink Variations for Apparel Printing

https://www.printrenegades.com/post/ink-variations

11)(2018)Types Of Ink Used In Screen Printinghttps://www.researchgate.net/publication/357871643_Advanced_Manufacture_by_Screen_Printing

12)Viorica ,C.The study of the screen printing quality depending on the surface to be printed.(2018), MATEC Web of Conferences
https://www.academia.edu/96320853/The_study_of_the_screen_printing_quality_depending_on_the_surface_to_be_printed?uc-g-sw=43199132

13)WHAT IS SCREEN PRINTING

https://www.jujo-chemical.co.jp/e/screen_printing/index.html#:~:text=Characteristics%20of%20screen%20printing&text=Screen%20printing%20makes%20it%20possible%20to%20print%20on%20the%20substrates,kinds%20of%20ink%20are%20available.&text=Thick%20coating%20makes%20colors%20more,to%20print%20on%20fragile%20matters

14)https://www.colorvisionprinting.com/blog/what-is-4/4-printing-4/1-printing-and-4/0-printing#:~:text=You%20may%20be%20surprised%20to,to%20produce%20full%20color%20images