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Identifying Optimal light guide plate (LGP) printing Parameters by Weighted Product Model

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Abstract

From PMMA resin acrylic panel light guide plates are made. PMMA is highly clear, it is unaffected by weather, and its average life is 30 years. In this paper, a Weighted Product Model is used for identifying LGP printing parameters in which various variables like the hardness of scraper, velocity, illumination, the mixed rate of ink, homogeny, pressure, VAR of illumination are determined. In this method of Weighted Product Model rank of various alternatives are calculated. By using Weighted Product Model analysis, the printing processing parameters such as velocity, pressure, the angle of the scraper of printing process are optimized by considering the multiple printing responses, including homogeny, the value of variance for the illumination, and printing ink thickness illumination.

Keywords: Light Guide Plate; weighted product Model; Printing Parameters

Introduction

Inkjet printing was performed utilizing a financially accessible piezoelectric Drop-On-Demand ink-stream Dimatix DMP 2800 printer. Nozzle diameter of printer head is 20 mm. For an independent movement and positioning of substrate holder the X and Y stages of the printers are used. The tallness of the print head which grip the nozzle is controlled by Z axis movements. To record drop injection and satellite drops CCD (Charge-Coupled-Device) camera is used. The substrate holder is heated up to 70˚C. [1]. In LGP without dot printing, the light source is used on the incoming side of coming light as it is situated in a tube or an LED, and in the middle, there is no light. The ink stain consists of PMMA acrylic powder, LGP radiates light for smooth graphic presentation. [2]. PMMA light guide plates utilized in the process of LGP cutting, and to reduce time reversed parts secondary processing was utilized. This procedure computes the most extreme stack amount of the financial polymethyl methacrylate extensive plate and directs the greatest slicing inside the unit plate to leave a held territory of about 0.5 mm in the one-sided side to abbreviate the preparing time. [2]. Milling of LGP is utilized to direct the process in small plates whether it is coarse or fine. Comparatively the milling has applications in large area than other processing and hence with the help of outsourcing it is done. Processing is the essential apparatus hardware required for LGP preparing. Distinctive kinds of machines and shapes require diverse shape plans of the machine. In this way, coarse and fine preparing of the shape ought to be directed on account of cut little plates. For small cut plate shape like coarse and fine is conducted. [2]. There is maximum shading efficiency available at the face where shading had been done. Therefore, to achieve maximum efficiency of shading in both the LGP polished in one directionally and/or multi directionally. [2]. The LGP cutting, processing and cleaning procedures will result in powder in the LGP, which ought to be cleaned utilizing a clothes washer, to keep away from the effect of LGP contamination on the LGP printing. [2]. As the printing ink is wet UV tunnel thermal heating machine in large scale manufacturing is used to reduce the time and to dry the LGP, in order to achieve stable response before storage, testing and package. [2]. in this printing process (LGP) it is proved that optimal procedure is effective and feasible. [3] In this printing process (LGP) the processing parameters (optimal) are extremely significant for reducing time and expenses. [3]. The LGP guides the bearing of the light so as to improve brilliance and consistency. [1]

Since, the LGP is an extreme crucial part for backdrop illumination module and light output. To change the direction of light travelling visual micro patterns is needed in light guide. [1]. Substrate of the LGP, stress-actuated birefringence is acquainted with accomplish the polarization state change. [4]. to acquire high energy efficiency in LGP with novel is reach, and top shining vigour is twice as great as regular backlight. [4]. As compared to single side of the LGP micro attribute of two side has more glow. Half of the brightness is improving in LGP with V groves, and full glow can be increased by using pyramids. [5]. for managing brightness as well as uniformity LCD in the LGP is very important part in the particular module [6]. Using WPM analysis, various printing variables are optimized using multiple responses of the machining such as printing ink thickness, VAR of illumination and homogeny. In this LGP study printing process represents the optimum feasibility. The request of visual attribute of LGP contains glow and the other is homogeny. Printing ink extent influences the light refraction and includes the Capitalized expense too. In this way, for the an LGP printing process, it is a fundamentally imperative to adequately obtain the ideal preparing parameters and to alter the components for diminishing the experimentation time and the expending cost; meanwhile, the different execution qualities of splendor, printing ink thickness and homogeny are as require for too. The exploratory examinations were performed on the ATMART56/G high exactness in the white room using screen printer of optoelectronics. The value of velocity of the head of the printing is settle between 0 to 835 mm/s and pressure value is settle between 5 to 8 kg/cm^2. In this Investigation, LGP of 6" is utilized as a trial entity and LED utilized as a source of light. In the standard requests of optical trademark for a business LGP, the basis of brightening is more than 330 cd/m^2, the level is over 70% of homogeny and the printing ink thickness was set as 8±1 μm, individually [7]. At least 10V voltage is required to release polyacrylamide-based ink and under this magnitude there is not sufficient power to generate drops. As the voltage is grow from 10 V to 12V the size of the drop is also grow and above 13 V the drops are not stable and not consistent satellites. These satellite drops affect the patterns and this drop causes short in the circuit of inkjet printing, and hence it is not suitable for processes of manufacturing. When the distance is very tiny the satellite points are noticed.

Materials and Methods

The process contains 5 input parameters and 3 output responses. Among the 3 output responses, illumination and homogeny are of beneficial type i.e. the goal is to maximize these. However, the third output response value of variance (VAR) of illumination is to be minimized. Keeping in mind these varied goals, four cases are built. In all cases the weight is equal among criterions.

Case 1: All three parameters are considered.

Case 2: Only beneficial type output responses are considered.

Case 3: Illumination and VAR of illumination are considered.

Case 4: Homogeny and VAR of illumination are considered.

The aim is to optimize the process parameters. Several optimization algorithms like ANN [8], GA [9-12], PSO [13-16], Cuckoo search [17-19], Ant colony [20-21] etc. are available for this task. Alternately, a lot of MCDM techniques like WSM [22-23], TOPSIS [24-26], WPM [27], PSI [25], Six-sigma [28] etc. also can be used. The basic concept in the TOPOSIS method is that the small interval between the absolute & selected alternative and negative absolute solution from extreme distance in a geometrical perception [29]. It is not easy to select alternatives with multiple attributes in decision-making. In particular, when the data of the alternatives is uncertain, imprecise, and subjective the decision is not easy [30] The MADMWP is similar to WSM and also considered as Multiplicative Exponent Weighting (MEW). MEW is one more model of MADM scoring, the principal dissimilarity is instead of summing the usual in mathematical operation product is used. The MADMWP is a limited set of different decisions related in the denomination of some criteria for decision [31].The formula for calculating the WPM is given below.

$$P(A_k) = \prod_{j=1}^{n} (a_{kj})^{wj} \quad \text{for } K = 1,2,3,\ldots\ldots,m$$

$$P(A_K/A_L) = \prod_{j=1}^{n} (a_{kj/a_{Lj}})^{wj} \quad \text{for } K, L = 1,2,3, \ldots\ldots, m$$

Results & Discussion

In the LGP process, the maximum value of Illumination shows better printing process for case 1. The rank is 1 for experiment 10. As shown in table 1, the minimum value of VAR illumination shows better printing for case 2 the rank of experiment 10 is 1. In case 3 the rank of experiment 8 is 1 and in case 4 the rank 1 for experiment 9.

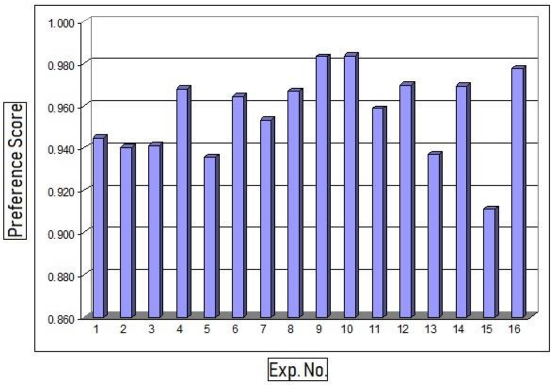
Table 1: Input variables and experimental responses

Exp no.	Mixed rate of ink(%)	Velocity (mm/s)	Pressure (kg/cm2)	Hardness of scraper(HRC)	Angle of scraper	Illumination (cd/m2)	Homogeny (%)	VAR of illumination
1	30	400	5.5	60	70	326.013	65.11	2.528
2	30	450	6	65	75	328.387	63.21	2.507
3	30	500	6.5	70	80	325.887	62.11	2.439
4	30	550	7	75	85	333.44	66.98	2.472
5	35	400	6	70	85	333.327	63.22	2.584
6	35	450	5.5	75	80	333.113	69.03	2.574
7	35	500	7	60	75	335	66.22	2.573
8	35	550	6.5	65	70	336.893	65.21	2.441
9	40	400	6.5	75	75	335.743	70.12	2.489
10	40	450	7	70	70	342.003	69.21	2.497
11	40	500	5.5	65	85	333.753	66.43	2.528
12	40	550	6	60	80	336.747	69.21	2.568
13	45	400	7	65	80	331.08	62.98	2.547
14	45	450	6.5	60	85	330.043	70.53	2.567
15	45	500	6	75	70	328.103	59.12	2.577
16	45	550	5.5	70	75	331.147	70.98	2.528

Table 2: Ranking of various alternatives

Exp. No.	Rank			
	Case 1	Case 2	Case 3	Case 4
1	11	11	14	10
2	13	14	9	13
3	12	15	5	12
4	6	7	4	5
5	15	12	13	15
6	8	6	12	7
7	10	8	10	11
8	7	10	1	8
9	2	2	3	1
10	1	1	2	3
11	9	9	6	9
12	4	4	7	6
13	14	13	11	14

14	5	5	15	4
15	16	16	16	16
16	3	3	8	2



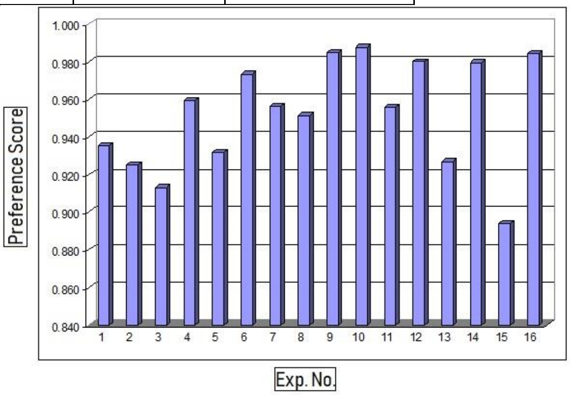
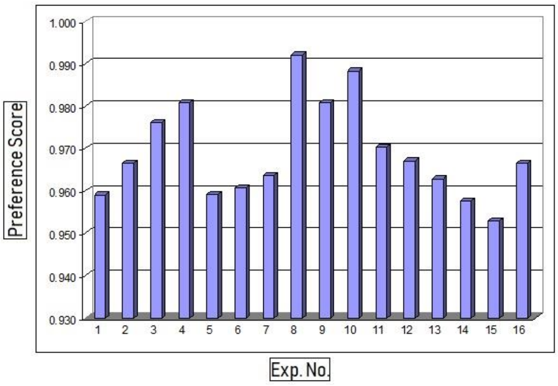


Fig. 1: Preference score of various alternatives for case 1 Fig. 2: Preference score of various alternatives for case 2

For case 1 the rank of experiment 10 and 9 is 1 and 2 respectively which shows good performance. For the case 1experiment number 10 mixed rate of ink is 40 %, velocity is 450mm/s, pressure 7 kg/cm^2.Similarly, for the same case 1 mixed rate of ink is 45 %, velocity is 500mm/s, pressure 6 kg/cm^2 for poor rank. For case 2 the rank of experiment number 10 and 9 are 1 and 2 respectively, which shows good result; angle of scraper and hardness of scraper values are 70 and 70 respectively for good result and for the poor result, the values are 75 and 70 for the hardness of scraper and angle of scraper.



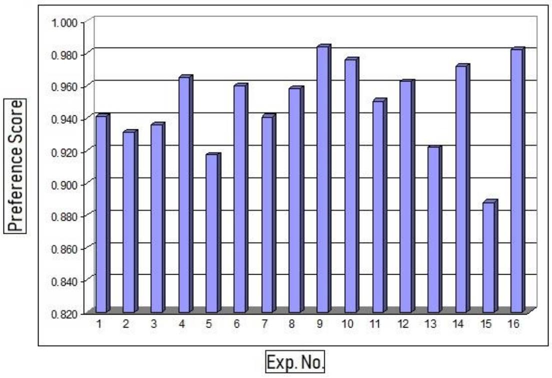


Fig. 3: Preference score of various alternatives for case 3. Fig. 4: Preference score of various alternatives for case 4

For case 3 the first two ranks for the experiments are 8 and 10 for better result of the various alternative; also, there is the poor result is for the 15 and 14 number experiment. The value of illumination and VAR of illumination for a good result are 336.893 and 2.441. Similarly, for the case 4 experiment number 9 and 16 are good as compared to other experiment and experiment number 15 and 5 which shows the poor result. The value of homogeny and VAR of illumination are 70.12 and 2.489 respectively, and for the poor result the comparative values are 59.12 and 2.577.

Conclusion

In this paper, during the process of printing the method of Weighted Product Model situated on the orthogonal array is suggest to attain multi response characteristics optimization. From this paper we can conclude that the optimum procedure for Weighted Product Model this study can greatly improve the printing rate in LGP printing by considering various alternatives. For the mixed rate of ink, velocity and pressure for case1 experiment 10 show better result; similarly, for the case 2 for alternative hardness and angle of scraper for case 3and 4 experiment number 8 and 9 shows good result. Experiment number 15 in all four cases shows the poor result.

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