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Design , Analysis of Effect of Entry Material on CNC Drilling on PCB Manufacturing

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Abstract - *Last forty years there is tremendous research in machining and development in technology. With increase in competition in market and to attain high accuracy now a days the non-conventional machining are become lifeline of any industry. One of the most important non-conventional machining methods is CNC flame Machining. It high accuracy, finishing, ability of machining any hard materials and to produce intricate shape increases its demand in market.*

The best product dimensions and the minimization of time and cost of production has become a measure of concern. Drilling process takes care about 35% of all the machining processes and influences the acceptability of the products as the drilling process is at the most final processing stage in the production line. The burr, which is a plastically deformed material, generated during drilling is unnecessary output and often lowers the surface quality, reduces the product life and acceptability of the product. Total elimination of burrs during drilling process is a difficult task, however, with proper selection of process parameters it can be minimized.

1. INTRODUCTION

A printed circuit board (PCB) mechanically underpins and electrically associates electronic parts utilizing conductive tracks, cushions and different highlights carved from copper sheets covered onto a non-conductive substrate. PCBs can be single sided (one copper layer), twofold sided (two copper layers) or Multi-layer Multi-layer PCBs take into account significantly higher part thickness. A thin layer of copper thwart is overlaid to one or the two sides of board. Hardware interconnections are carved into copper layers to deliver printed circuit sheets. Printed circuit sheets are utilized as a part of everything except the easiest electronic items. Contrasting options to PCBs incorporate wire wrap and point-to-point development. PCBs require the extra plan push to lay out the circuit, yet assembling and get together can be mechanized. Assembling circuits with PCBs is less expensive and quicker than with other wiring strategies as segments are mounted and set up with one single part. Moreover, administrator wiring mistakes are wiped out. In this undertaking we will ponder the different PCB materials like Aluminum, Bakelite and Copper and will contemplate its impact on boring procedure.This project is sponsored by M/s- Epitome Components Ltd, Supa MIDC, Ahmednagar.

1.1 Problem Statement

i. Proper heat dissipation to avoid thermal expansion.

ii. To absorb hammering force and avoid delamination of copper

Proper hole quality with high precision

1.2 Necessity of work

The primary capacity of PCB is to exchange power and create an opening through the board that will allow a resulting procedure to shape an electrical association. For that reason nature of opening ought to be great, Micro boring required fast and high power because of that best surface of PCB material get harmed. To maintain a strategic distance from this harm defensive passage material is utilized.

1.3 Objective of work

i. Analytical design of “Effect of entry material on PCB”.

ii. Modelling and Simulation of “Effect of entry material on PCB”.

iii. Preparation of Prototype sample of “Effect of entry material on PCB”.

iv. Experimental workout of “Effect of entry material on PCB”.

v. Study of comparative result of “Effect of entry material on PCB”.

2. MACHINE SELECTION

Manufacturer- Lenz

With an ever increasing demand for a greater hole count per panel, the new high power

linear motors offer a significant reduction in the drilling cycle time.

i. Robust, interlocked base unit

ii. High accuracy mechanical linear guides in all 3 axes

iii. High dynamic Linear motors for the X- and Y-axes, (Z-axes as option)

iv. CNC control systems

v. Variable clamping systems

Fig No. 2 : Lenz PCB drilling machine

Manufacturer- Lenz

2.1 Specification

i. Single spindle lenz machine.

ii. Granite bed with length 4000mmX1400mm.

iii. Magazine capacity is 264 tools.

iv. Vacuum cleaner for dust remove.

3 MACHINE PARTS

3.1 Automatic Tool Changer (ATC):

Straightforward CNC machines work with a solitary apparatus. Turrets can work with an expansive number of instruments. In any case, in the event that we require significantly more number of instruments, at that point ATC is given. It enables the machine to work with countless without an administrator. The principle parts of a programmed apparatus changer are base, gripper arm, instrument holder, bolster arm and device magazines. Nonetheless, the ATC expands the dependability, speed and precision, yet it has likewise more difficulties as contrast with manual apparatus change like the tooling utilized must be anything but difficult to focus, be simple for changer to get and there ought to be some mean for giving the device self separation simple.

Function:

The utilization of programmed changers expands the profitable time and diminishes the useless time to a vast degree. It gives the capacity of the devices which are returned naturally to the machine apparatus in the wake of doing the required tasks, builds the adaptability of the machine instrument. Rolls out it less demanding to improvement substantial and vast apparatuses, and licenses the programmed restoration of front lines.

Fig No. 3.1: Automatic Tool Changer

3.2 Bed:

It is overwhelming obligation monstrous development to give solidness to maintain vast cutting dynamic power, heap of different components and so on. It is made of fantastic rock and it goes about as establishment for every single other piece of the machine.

Fig No. 3.2: Bed of Lenz CNC machine

3.3 Tool Magazine:

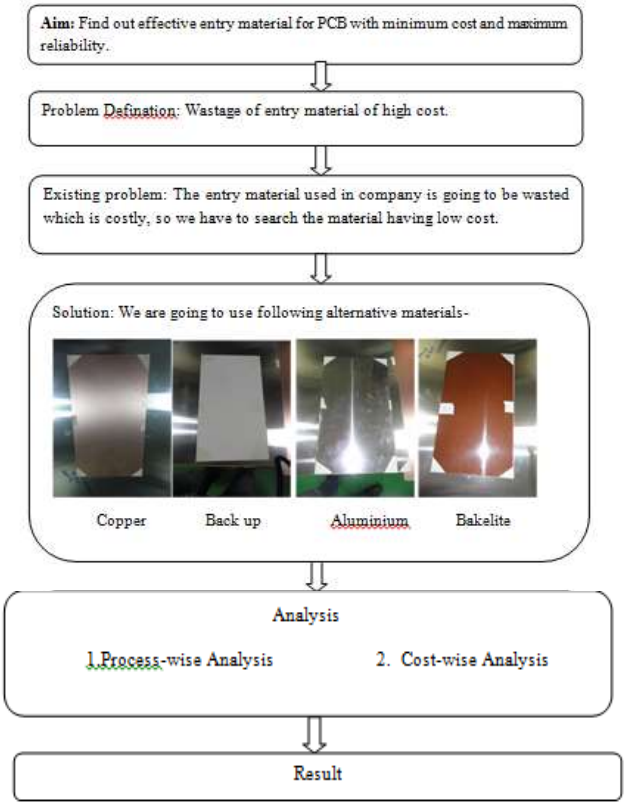
A two-phase approach is developed to solve the tool magazine arrangement and operations sequencing problems. The overall aim is to minimize the total manufacturing cost by utilizing the benefits of tool sharing concept and loading duplicate tools due to a possible decrease in tooling and tool operating costs while maintaining the feasibility in terms of precedence, tool magazine capacity, tool life covering and tool availability constraints due to tool contention among the operations for a limited number of tool types, because the

Fig No. 3.3: Tool Magazine

3.4 Controller:

The CNC (PC numerical control) arrangement of a machine device incorporates the control unit itself, and additionally less obvious parts of the movement control framework, for example, the servomotors, drives and hub situating gadgets. These segments are a piece of any CNC machine instrument, however they may be purchased independently and retrofitted later on more seasoned machines that are redesigned or renovated. Additionally part of the control framework are sensors that may enable the control to settle on certain constant choices amid unattended or gently went to machining forms. These can incorporate tests for estimating the situation of the part or machined highlights, and additionally observing frameworks for recognizing the nearness of the instrument or the power that is being applied in the cut.

Fig No. 3.4: Controller



RESULT ANALYSIS

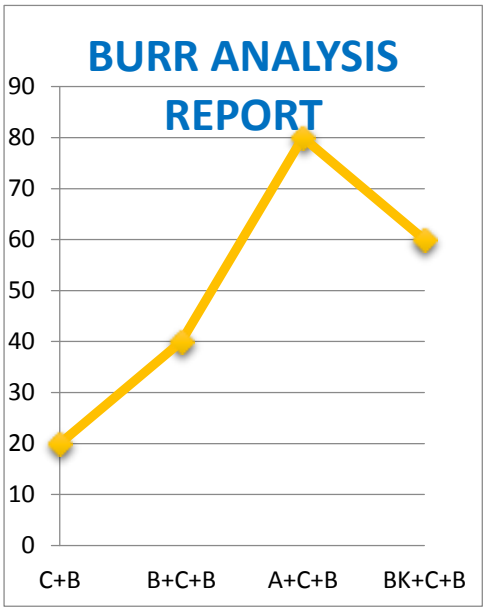
The correct passage material will enhance penetrated gap enlistment and lower the danger of bore breakage by limiting drill avoidance upon contact with the stack. All together for the passage material to work appropriately, it must be level and free of pits, marks, and scratches. Distorted or bent material will bring about expanded degrees of passage burrs and boring tool breakage. Surface flaws and materials that are too hard add to penetrate redirection, bringing about diminished opening enrollment exactness and breakage of little measurement drills. Phenolic materials or phenolic composites (i.e., aluminum-clad phenolic) frequently twist and under most penetrating conditions sully the gap divider, which brings about issues with adherence of the plating on the grounds that desmearing chemicals are not intended to evacuate phenolic tar. Strong aluminum materials of the right structure and hardness that are not of an over the top thickness, yet are not very thin, may work acceptably with bigger breadth boring tools. Be that as it may, boring with strong aluminum materials (0.008 in and thicker) may expand the danger of breakage of littler distance across drills. Aluminum-clad cellulose center materials give a hard surface to counteract burrs yet limit penetrate avoidance and breakage related with strong aluminum

SAMPLE TESTING:-

Testing Name:-Burr Analysis on top surface of the hole.

Machine Name:-Digital microscope tester

Burr analysis report

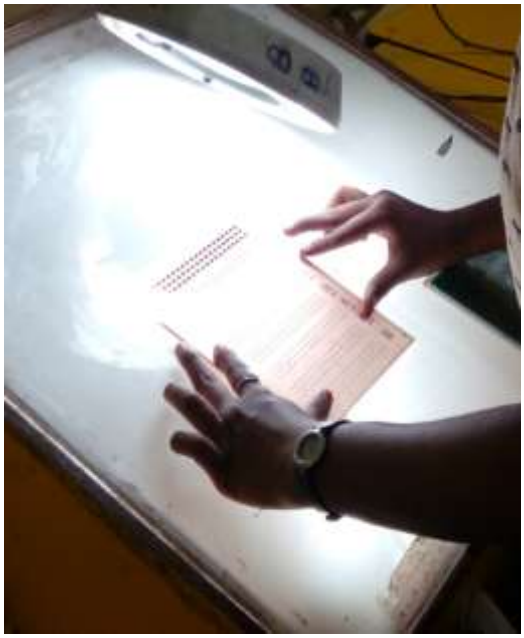


Compareitive statement graph

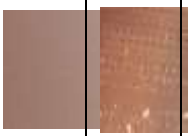
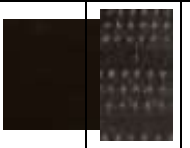
Sample no	Before Drilling	DMT Report	Remark
Copper + Backup			poor
Backup + Copper +Backup			good
Aluminum + Copper + Backup			best
Bakelite + Copper +Backup			better

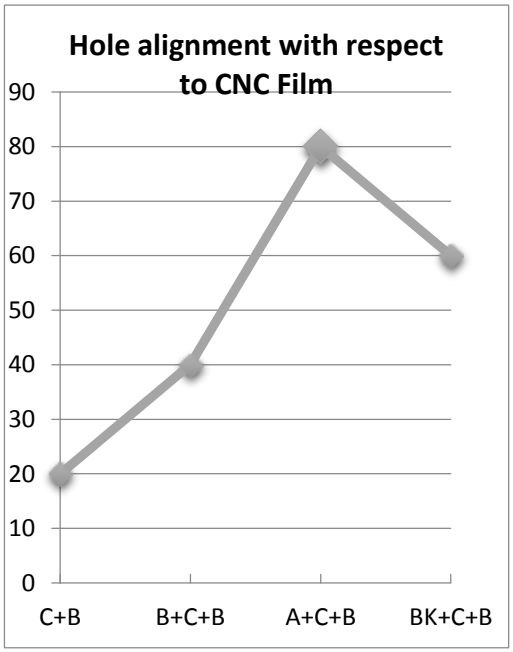
Testing Name:-hole alignment with respect to CNC Film

Machine Name:-CNC Film with White light inspections table



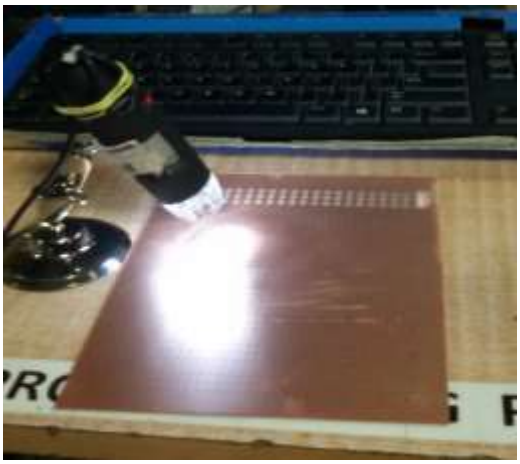
2) Along hole and alignment with respect to Master CNC Film Report

Sample no	Before Drilling	After drilling	CNC Film Report	Remark
Copper + Backup				poor
Backup + Copper +Backup				good
Aluminum + Copper + Backup				best
Bakelite + Copper +Backup				better

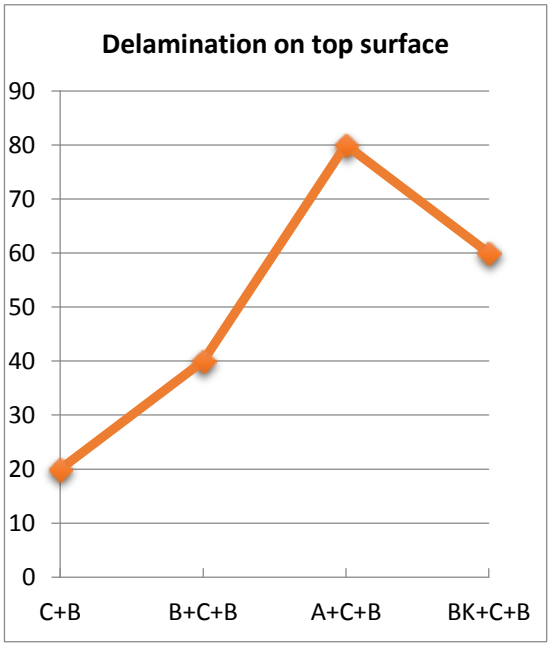


Testing Name:-Delamination on top surface

Machine Name:-Delamination microscope tester



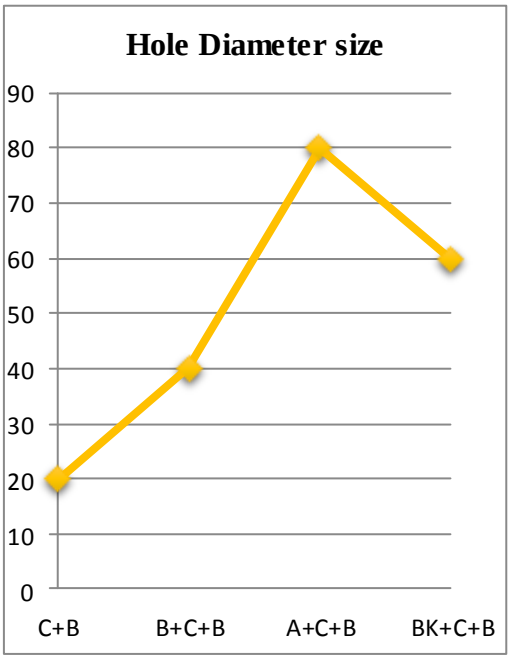
3) Delamination of cupper on top surface of the sample



Testing Name:-Hole Diameter size

SR	Hole(D)	C+B	B+C+B	A+C+B	D+C+B
1	0.85	0.82	0.83	0.84	0.84
2	0.90	0.86	0.87	0.89	0.89
3	1.00	0.97	0.98	0.98	0.98
4	1.10	1.06	1.07	1.09	1.08
5	1.20	1.16	1.17	1.19	1.18
6	1.50	1.47	1.47	1.49	1.48
7	2.00	1.97	1.97	1.98	1.98
8	4.00	3.96	3.97	3.98	3.98
9	0.80	0.77	0.78	0.79	0.79
10	2.00	1.96	1.98	1.99	1.90

Machine Name:-Diameter pin gauge with ISO standerd.



Analysis from graph

3. CONCLUSIONS

From the discussion so far it has been concluded that Aluminum is better entry material than copper, Bakelite or wooden material. Al will help in reduction in burr, plain surface finishing and better hole quality than other materials like copper, Bakelite, wood etc. Burr minimization techniques can be easily implemented in Al material. The overall conclusions from the investigations are:

• Burr reduction with increased speed.

• Burr reduction with reduced feed rate.

• Conical defect at hole entry can be eliminated by using high feed, short drill length, and drill point warranting good self-centering capability.

• Significant reduction of exit burr with properly constructed clamping system.

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