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Developmet of N95 Mask Manufacturing Machine

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ABSTRACT

The increasing prevalence of infectious diseases in recent decades has posed a serious threat to public health. Routes of transmission differ, but the respiratory droplet or airborne route has the greatest potential to disrupt social intercourse. In the absence of specific treatment, preventive strategies are of paramount importance in management of coronavirus disease 2019(COVID-19) pandemic. As estimated cost-effectiveness of nonpharmacological interventions such as hand-hygiene, surgical-mask N-95 respirators and surgical mask in general population. The ultrasonic welding (UW) technique is an ultrafast joining process, and it is used to join thermoplastic composite structures, and provides an excellent bonding strength. It is more cost efficient as opposed to the conventional adhesive, mechanical and other joining methods. So in order to meet the requirement of N95 mask so need to develop the production machineries on large scale so as to meet the consumers requirement. Sanitech Plasto-weld is the company developing plastic welding machines.

INTRODUCTION

A solid-state welding process in which coal produced at the faying surfaces by the application of high frequency vibratory energy while the work pieces are held together under moderately low static pressure. Ultrasonic welding, one of the most widely used welding methods for joining thermoplastics, uses ultrasonic energy at high frequencies (20 –40 kHz) to produce low amplitude (1 – 25 µ m) mechanical vibrations. The vibrations generate heat at the joint inter face of the parts being welded, resulting in melting of the thermoplastic materials and weld formation after cooling. Ultrasonic welding is the fastest known welding technique, with

weld times typically between 0.1 and 1.0 seconds. Composite materials are considered as the wonder material, as all the industries are obsessed to reduce weight and increase the specific stiffness. Fiber reinforced composites fit the bill perfectly and reduce weight significantly. However, there are still some associated obstacles to realize their true potential in the industrial manufacturing landscape. Polymer matrix composites are increasingly used in aerospace, automotive, marine, transport, sports and many other applications, as compared to conventional metals. This is due to lower weight, specific stiffness, corrosion resistance and high fatigue life, as compared to metals. Matrix systems used in composites are thermoset and thermoplastic. Recently, thermoplastic composites have become the most demanding material, as these provide numerous advantages over thermoset composites. Thermoplastic (TP) composites are preferred due to their excellent vibration damping, high impact resistance, high productivity, high damage tolerance, fracture toughness, recyclability, reform ability, being weldable and repairable, having flexural strength and their cost effectiveness compared to thermoset composites, and these properties attracted its usage for high end applications, such as manufacturing the fuselage and wing sections of an aircraft. Thermoplastic resin has an inherent ability to become softer once heated above the defined temperature range and retain their properties once they are cooled down. Hence, TP composites are an attractive candidate for the welding of two similar TP composite materials or a TP as per the industrial reports, the most anticipated research directions in the technological advancement of composite manufacturing technology for automotive, aerospace, sporting, marine, offshore and other applications.

LITERATURE SURVEY

"The Research of Ultrasonic Equipment Applied in Non-woven Welding", Chen Wei+ and Li Suxun The School of Information Science and Technology,Xiamen University, Xiamen and 361005, China [1] in their paper, an ultrasonic atomization welding system is discussed, which composed of the high frequency ultrasonic power supply and the transducer. The high frequency ultrasonic power supply provides appropriate electric for the transducer, and the transducer transforms the electric energy into the ultrasonic kinetic energy. This paper is focus on the theory analysis and the design of the power supply. Based on the analysis and argument of ultrasonic welding power, for ultrasonic welding of the specific requirements, designed the rectifier filter circuit, power amplifier, frequency track circuit, matching circuit, drive and protection circuit. In addition, analyzed the main part of the rectifier filter circuit, power conversion and other parts, gave the parameters of calculation and choice of methods. Effect of ultrasonic welding parameters on microstructure and mechanical properties of dissimilar joints, "N.H. Tariq c, M. Ahmad" Science Direct 55 (2014) 263–273[2] .Ultrasonic spot welding has received significant attention during past few years due to their suitable applications in comparison to

conventional fusion welding techniques. Fusion welding of dissimilar Aluminum and Stainless steel alloys is always a challenging task because of poor control on grain size and formation of undesirable brittle intermetallic compounds in the weld metal, which have deleterious effect on mechanical properties. In the past, welding of dissimilar alloys has been performed using electron beam welding, laser beam welding and friction stir spot welding, resistance spot welding, etc. How- ever, little work has been reported on dissimilar welding of Aluminum and Stainless-steel alloys using ultrasonic spot welding. The objective of the present work is to optimize ultrasonic spot-welding parameters for joining 3003 Aluminum alloy with 304 Stainless steels. Welding was performed at various clamp- Ing pressures (i.e., 30, 40, 50 and 60 psi) and energy levels for investigating its effect on microstructure, mechanical properties and bond quality of the weld. Different levels of weld quality i.e., 'under weld', 'good weld' and 'over weld' were identified at various welding parameters using physical attributes. The weld specimens prepared with energy 125 and 150 J showed the maximum bond strength and were rated as "good" weld. It was also revealed that for a good quality weld, the maximum tensile strength is achieved once a reasonable amount of bond density and material thinning (required for the formation of metallurgical bonds) is attained.

SYSTEM DESIGN

Mechanical design phase is very important from the view of designer as whole success of the project depends on the correct deign analysis of the problem. Many preliminary alternatives are eliminated during this phase. Physical properties of material, loads stresses, deformation, and failure all this information has been understood by us. Theories and wear analysis, to identified the external and internal forces acting on the machine parts. System design mainly concerns with the various physical constraints and ergonomics, space requirements, arrangement of various components on the mainframe of machine no of controls position of these controls ease of maintenance scope of further improvement; height of m/c from ground etc.

METHODOLOGIES

Composite materials are considered as the wonder material, as all the industries are obsessed to reduce weight and increase the specific stiffness. Fiber forced composites fit the bill rein perfectly and reduce weight significantly. However, there are still some associated obstacles to realize their true potential in the industrial manufacturing landscape. Polymer matrix composites are increasingly used in aerospace, automotive, marine, transport, sports and many other applications, as compared to conventional metals. This is due to lower weight, specific stiffness, corrosion resistance and high fatigue life, as compared to metals.

SYSTEM LAYOUT

As stated, system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact A compact system gives a better look & structure. Fig (1) shows the flow chart of process.Fig (2) shows the system architecture.

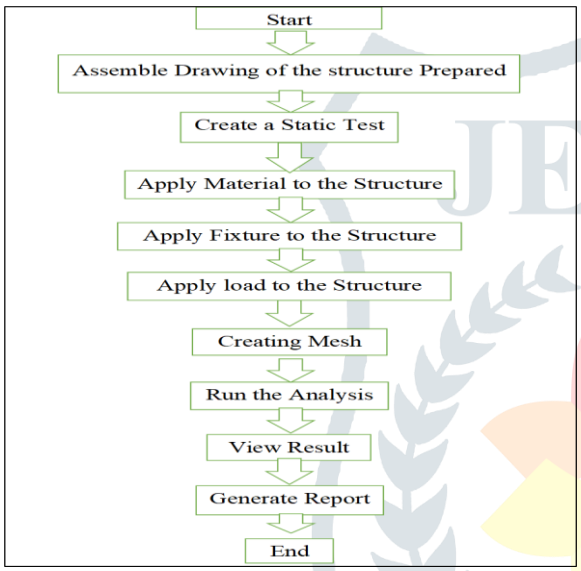

Figure 1: Flowchart

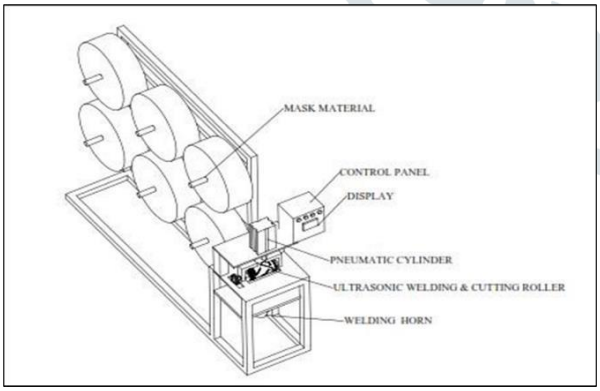

Fig 2: System Architecture

ANALYSIS USING ANSYS

For any experimentation work carried out by anybody validation of that work is most important phase for the experimentation.
Validation gives the proof of data and result, which is carried out from experimentation work.
For above all mention work to validate that work with different FEA tools like, ANSYS 15.0, CATIA V5R20 fig(3.4). Table (1) shows the load results of the structure.

Component	Load	Stress (MPa)	Deformation (mm)	Ultimate stress (MPa)	FOS
Top Frame	250 N	92	3.2	240	3.5

Table 1: Result

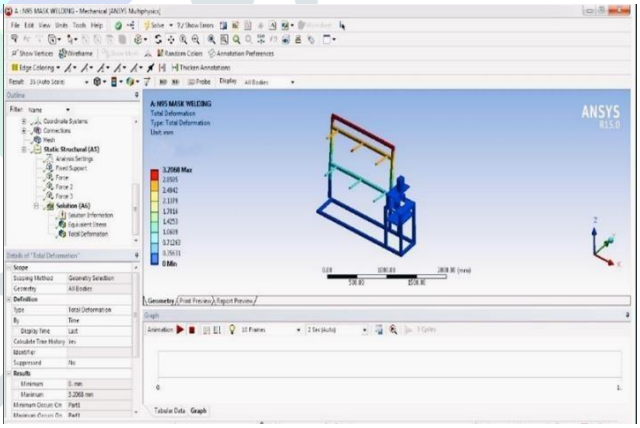

Fig 3: Analysis of structure

PRODUCTION RATE AND RESULT

Production rate, in terms of manufacturing, refers to the number of goods that can be produced during a given period of time.

Alternatively, the production rate is also the amount of time it takes to produce one unit of a good.

The production rate for construction companies might be the rate at which workers should complete a certain task. Fig (3,4) represents the mask produced and rejected items per hour.

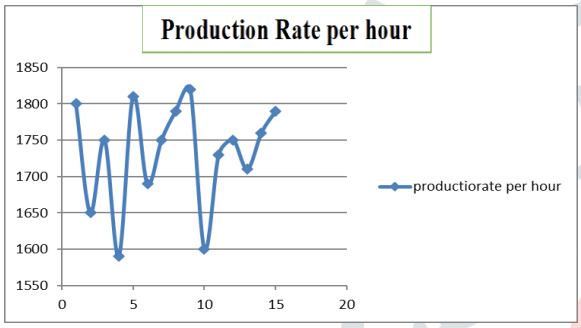

Figure 4: Production per hour

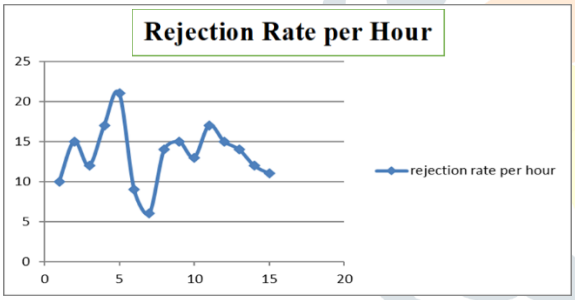

Figure 5: Rejection rate per hour

FUTURE SCOPE

1. Further this machine can make KN95 mask according to Chinese and Korean standards.

2. Can also make advancement in making foldable pocket friendly masks.

3. Further addition of automatic waste collection system and PLC control, with touch screen display with easy humanized operation concept .

4. For making N99 masks as per American standards.

5. Automatic nose strip insertion system installed.

CONCLUSION

Presently, the ultrasonic system is widely used in the people's livelihood. such as ultrasonic pulverization in the pharmacy, ultrasonic welding and ultrasonic washing in the spinning and weaving, ultrasonic test and ultrasonic crack detection in the projection. The production time is reduced upto 15% than the usual mask manufacturing machine using ultrasonic welding. The quality is also enhanced as compared to other mask. At the same time, it has testified that ultrasonic has improved efficiency and brought convenience. For different applications, we should base on the different function step by step complete the theory analysis and the design then take the specific applications for it.

ACKNOWLEDGEMENT

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