Ultrasonic Toy Welding Machine

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Abstract- *The ultrasonic welding (UW) process is an one of the fastest joining technique, and It finds uses in join thermoplastic composite structures, and provides a superb bonding strength. It is more cost efficient as against the traditional adhesive, mechanical and other joining methods. In this paper, an ultrasonic molecular atomization welding system is considered, which consists of the and the transducer high frequency ultrasonic power supply. The high frequency ultrasonic power supply provides electricity for the transducer, and thus the transducer converts the electric energy into the ultrasonic kinetic energy. This project is specialise in the idea analysis and the design of the mechanical system. Assumed from the analysis of ultrasonic welding power, for ultrasonic welding of the precise requirements, other parts, gave the parameters of calculation and choice of methods.*

Keywords- ultrasonic, plastic, thermoplastic, adhesive, atomization, high frequency, transducer, design, welding .

I. INTRODUCTION

Composite materials are considered because the wonder material, as all the industries are obsessed to scale back weight and increase the precise stiffness. Fiber reinforced composites fit the bill perfectly and reduce weight significantly. However, there are some obstacles to realize their true potential within the industrial manufacturing landscape. Polymer matrix composites are increasingly utilized in aerospace, automotive, marine, transport, sports and lots of other applications, as compared to conventional metals . This is thanks to lower weight, high fatigue life, corrosion resistance and specific stiffness, as compared to metals. Matrix systems utilized in composites are thermoset and thermoplastic. Recently, thermoplastic composites became the foremost 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, reform ability, recyclability, being weldable, fracture toughness and can be repaired, 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 body and wings of an planes. Thermoplastic resin has an fundamental ability to get softer when heated above the defined temperature range and retain their properties once they are cooled down. Hence, TP composites are an good choices for the welding of two similar TP composite materials or a TP

II. JOINING TECHNIQUES OF PLASTIC MATERIALS

Mechanical Fastening-

It presumes the utilization of additional parts (fasteners) such are bolts, polymeric of metallic screws, rivets, washers or it relies on integrated design elements such as snap-fit or press-fit joints. Mechanical fastening are often wont to join both similar and dissimilar materials. For example, mechanical fastening is commonly used to joining a plastic to a metals, producing nonpermanent joints or connections that can be opened and sealed again. The important advantages of this approach are that disassembly of the components for inspection and repair is straight forward and no surface treatment is necessary. The important limitation is increased weight, the presence of higher stress concentrations round the fastener holes, and subsequent in-service corrosion problems. The typical applications of mechanical fastening are within the aerospace, automotive, and construction industries. In adhesive bonding, an adhesive is applied in between the parts to be bonded (adherends)where it is the fabric that bonds the parts and distribute the load through the joint. In solvent bonding, the appliance of a solvent at the bond line induces sufficient mobility for the polymer chains to inter diffuse. Because the solvent must firmly plasticize the polymer surface, this joining technique is mainly applied to glassy amorphous thermoplastics, like polycarbonate (PC), acrylic (AK), and polystyrene(PS) resins. These techniques are widely used because of their low cost and adaptability to high-speed production. In addition, adhesive and solvent bonds gives a uniform distribution of stresses than other over the joined areas and a high strength to-weight ratio. Solvent bonding is applicable just for joining of amorphous thermoplastics, whereas adhesive bonding are often used with most plastics.

Welding-

Plastics like polypropylene are difficult to weld are usually assembled using induction welding. Vibration welding is efficient but is usually only employed when other bonding methods are impractical. Vibration welding joins two plastics by vibrating one among them. The vibrations generates friction, which heat the plastics and weld them together. To perform an induction weld, plastics are placed around a metal object and run through a magnetic flux , which causes the plastics to heat and weld together.

III. MATERIAL SELECTION

The proper selection of fabric for the various a part of a machine is that the main objective. In the fabrication of machine. For a design engineer it's must that he be conversant in the effect, which the manufacturing process and warmth treatment wear the properties of materials. the selection of fabric for engineering purposes depends upon the subsequent factors

Pneumatic Cylinders-

2.5 mm air cylinder, which could be used for selecting up a little transistor or other electronic component, to 400 mm diameter air cylinders which might impart enough force to lift a car. Some pneumatic cylinders reach 1000 mm in diameter, and are utilized in place of hydraulic cylinders for special conditions where leaking hydraulic oil could impart an higher damages The pneumatic cylinders made for educational use generally have transparent outer sleeves, so students can see the piston moving inside. The pneumatic cylinders designed for white room applications often use lubricant-free Pyrex Glass pistons sliding inside graphite sleeves. Here the material used in pneumatic cylinder is ST-52 (Steam less Tube).

Valves-

Valves control the flow of compressed gas to a cylinder. They can be used to switch the air on or off, change the direction during which the air is flowing or maybe hamper the airflow. The most common sort of valve is that the 3/2 valve

FRL Unit-

It is a tool that conditions air to be used in pneumatic systems. An FRL may be a combination filter-regulator-lubricator. FRL units have semi-auto-drain function and therefore the body is formed of die casting aluminum alloy, thus making them sturdy to work in industrial environments. The FRL units are utilized in various industries like food processing, paper and packaging, pharmaceutical and textile. Offered at affordable prices, FRL units are robust in design, construction and are ideal to be utilized in tough working conditions.

Design Of Frame–

The Frame designed for our project which is made up of M.S.It is welded as per arrangement of the system components. The Frame along with dimension is shown in figure below

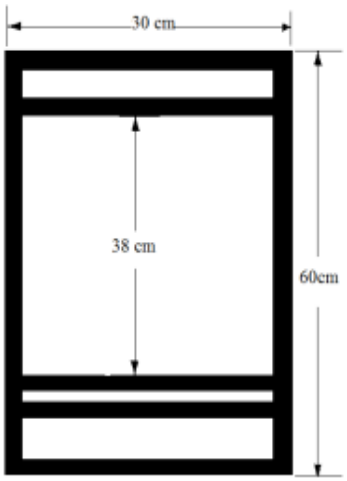


Fig Specification of frame

Frame Specification:

- Size of Frame: 1000 x 350 mm
- Material of Frame: Mild Steel
- Unloaded Weight of Frame: 2.65 kg
- Loaded weight of frame: 9.7 kg

PLC Selection-

Select TWIX-1-230V ABS Plastic PLC (Black)System CAD Design

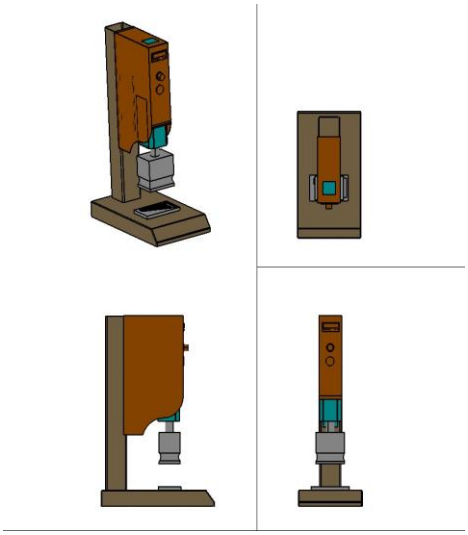


Fig. System Designed Using Catia V5R20

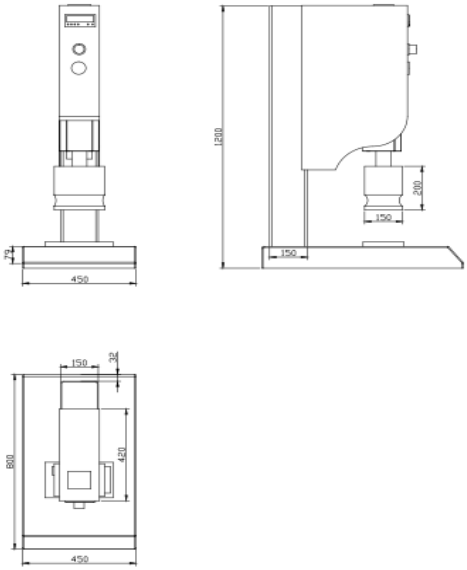
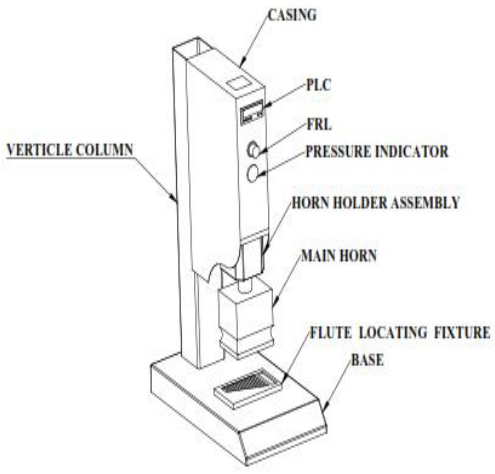


Fig Drafting Done Using AutoCAD 2014



IV. FABRICATION

Fabrication includes the manufacturing processes which we utilized in our project to manufacture the final assembly. The manufacturing processes that were used in assembling process are as follows:

Grinding-

Grinding is an abrasive machining technique where grinding wheel used as the cutting tool. A wide range of machines are used for grinding:

- Hand-cranked knife-sharpening stones (grindstones)
- Handheld power tools for example angle grinders and die grinders
- Bench grinders

Grinding practice may be a large and diverse area of producing and gear making. Itcan give very fine finishes and very accurate dimensions; yet in production contexts it also can rough in large volumes of metal quite rapidly. It is usually usedin the machining of very hard materials than is conventional machining (that is, cutting largerchips with cutting tools like tool bits or milling cutters), and until recent decades it had been the only practical thanks to machine such materials as hardened steels. Compared to "regular “machining, it's usually better suited to taking very shallow cuts, like reducing a shaft diameter by half a thousandth of an in. or 12.7 μm.

Welding-

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing fusion, which is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal. In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material (parent metal). Pressure may also be used in conjunction with heat, or by itself, to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized. Drilling is a cutting process that uses a drill bit to cut a hole of circular cross- section in solid materials. The drill bit is usually a rotary cutting tool, often multi- point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work- piece, cutting off chips from thehole as it is drilledIn rock drilling,

the hole is usually not made through a circular cutting motion, thought bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements

V. RESULT

Design Analysis-

Design Of Chassis-

Given figure shows the structure of Chassis. The drawing indicates that the location for joining front nose, the cockpit and location where rear wing will be connected.

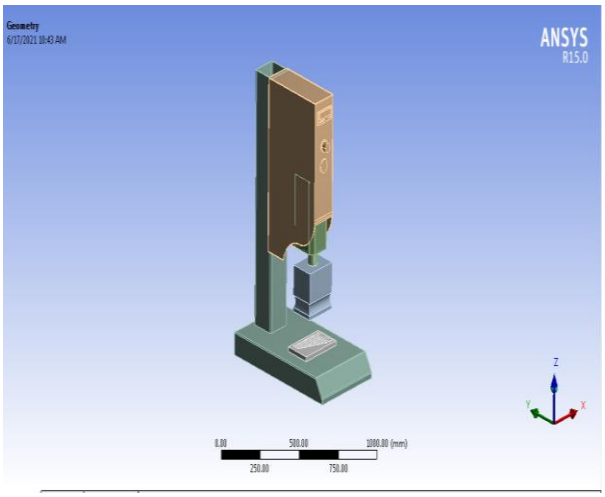


Fig. Three dimensional drawing of basic chassis 1.

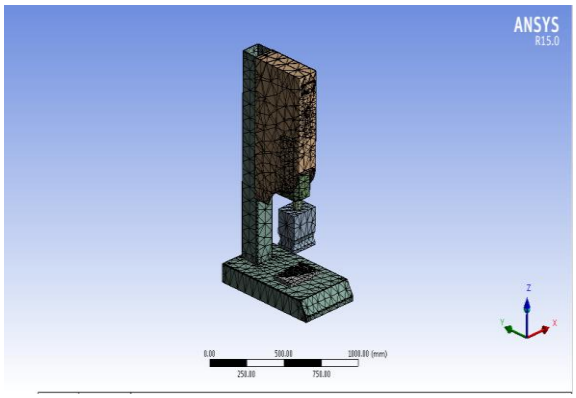


Fig. Meshed Structure of the Chassis

In meshing all the elements used are quad elements, where 5% trial elements are allowed but trial elements are stiffer so that the flow of stress distribution varies and does not give accurate results.

Boundary Conditions

Force Applied + 250 N

Fixed at bottom :

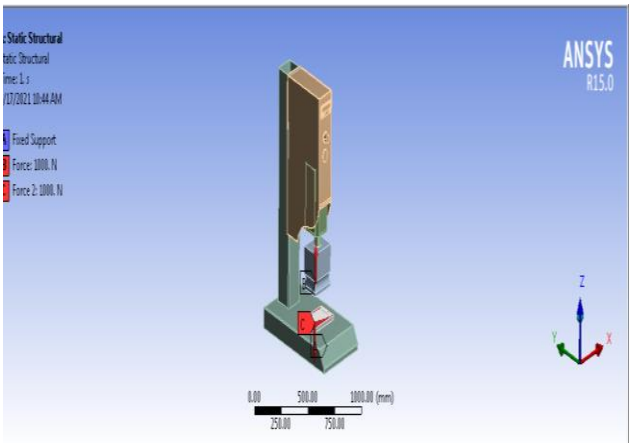


Fig. Boundary Condition

Von Misses Stress Result

In this result we obtained Von misses stress is 1.45 N/mm^2 which is negligible under maximum loading conditions so the result interpretation is very safe because material yield strength is more than induced stress

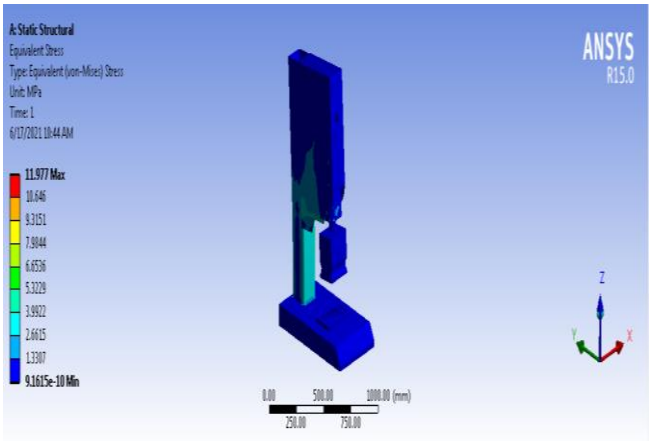


Fig. Von Misses Stress Result

Displacement Result

In this result we obtained deformation 0.006 mm which is negligible under maximum loading conditions so the result interpretation is totally safe.

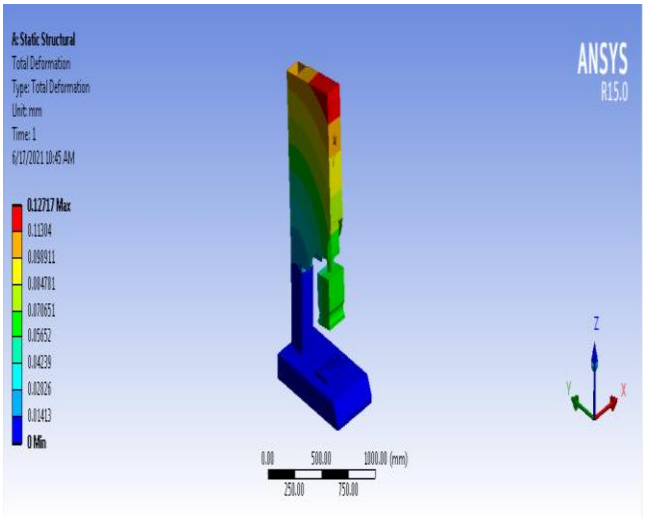


Fig. Displacement result

	Load	Stress (MPa)	Deformation (mm)	Ultimate stress (MPa)	FOS
Chassis Top Frame	250 N	11.45	0.112	230	21

Since the value of FOS is Greater than 2 our system designed is safe for load capacity 100 kg

VI. 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. At the same time, it has testified that ultrasonic has improved efficiency and brought convenience. For different applications, we should based on the different function step by step complete the theory analysis and the design then take the specific applications for it.

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