IMPLEMENTING AND DEVELOPMENT OF SIMPLIFIED FIXTURE FOR FSW.

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Abstract : Friction stir welding process have been well accepted in the field of Welding. While performing FSW one experimental basis the plate size considered is 100 x 100 x T, here T is thickness of plate. The facts found while designing and e experimenting were interesting. The development phase has given exposure to points which have not been considered while constructing fixtures for holding plates while carrying e experimentations. The effects found on plate while changing parameters have also changes the results. Here design have been trialed for various e experiments and on basis of practical understanding of problem physics one design have been finalized for further e experimentations. Experimentations have been carried and with Multiphysics problem have been solved. On basis of practical and Multiphysics data design have been presented.

Key word - Fixture; FSW Fixture; load cell fixture FSW, 3axis tool dynamometer for FSW.

I. IN TRO DUC TION

FSW have been trialed by various scientists to gain various quality welds in different ferrous and nonferrousmaterials. Here standard procedure suggests to clamp a plate on milling machine bad or they clamp it bymechanicalmeanslikeholding clamps.Todesign FSWfixturestudyhave been carried on basisofexperimentswithsensorsystemsandload cells.Heredesignanddevelopmentispresented withunderstandingofproblemphysics.

FSW is process which needs less resources as compared to other welding processes. The design of fixtureinvolves trial testing to gain data for loading during plunge, dwell, feed and retrieval of tool from plate. Thetemperature of weld platehasalso been measured before, during and after weld. The FSW represents multiple physics at same time. It starts with frictional heat addition in plate while plunge. At same timestirring of base material occurs. Here the load developed within plate and tool tries to move plates in verticaldownward direction, lateral direction and moving advancing side as well retrieving side plates. The forceswill further develop on switching on feed. The heat due tofriction increases rapidly.The material availableat region of plunge and tool travel path get plasticized and getting stirred in the region with change in itsgrain size as well in microstructure. Different phases have been developed which are stir zone, Heat effectedzone, TMAZ, Base material. Heat is generated and dissipated through the material plate as well through thefixturebaseplateand other constructions.

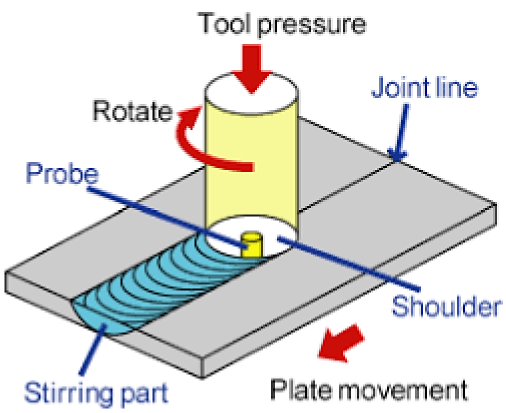


Figure1friction stirweldingprocesspresentation

Herefigure 1representsweldingphenomenaonplates.Availabl emethodsforclampingplates:

a) *Clampingplatesonguidewayofmillingma chine:*

The available method was the general method to hold plate to perform sheet metal operations. Here thedrawback involved is we have to place clamps properly to hold the plate tightly on milling bad. The clampheight while placement may create movement problems for tool. And miner misalignment while placementcreatemajordefectinplate.Thisforma tion isnotappreciatedforBobbintoolFSW.

b) Fixtureplates:

The fixture plates are produced by generating cavity in side metal plate of specific material (i.e. SS, Diesteel).it contains cover plates to hold material in the cavity. This formation helps to do FSW as well measure load during plunge and processing in Vertical direction. But it is difficult to measure load produced inlongitudinalaswelltransversedirection.Thisf ormationalsonothelpsin BobbintoolFSW.

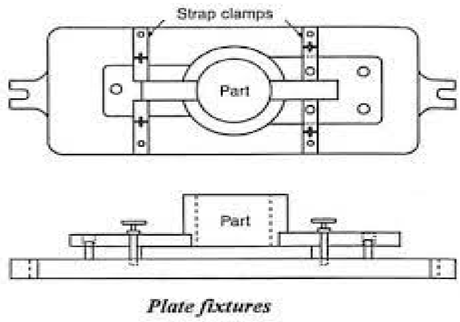
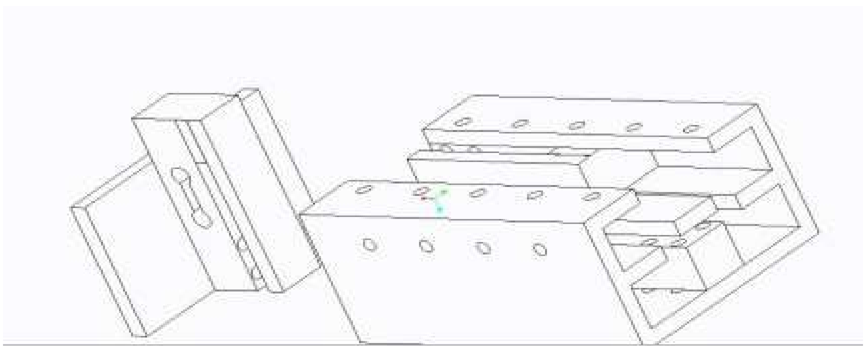


Figure2:FlatPlatetypefixture

Here new approach have been designed to hold the plates for clamping them firmly with the base of FSWmachinewithmeasurementcapabilities.

I. DEVELOPMENTSINDESIGN

Heredevelopmentindesign havebeenproposed asshownbelow.



The fixture proposed here is good for experimental investigation carried to investigate the process but theindustry need simple and manufactural product, due to this the development have been carried to developfixture which is simple in manufacturing as well easily mountable on all kinds of milling machines bad. Duetothisconceptofeasy manufacturabilityfollowingdevelopmenthavebeendefined.

The resultplothas beenpresentedhere.

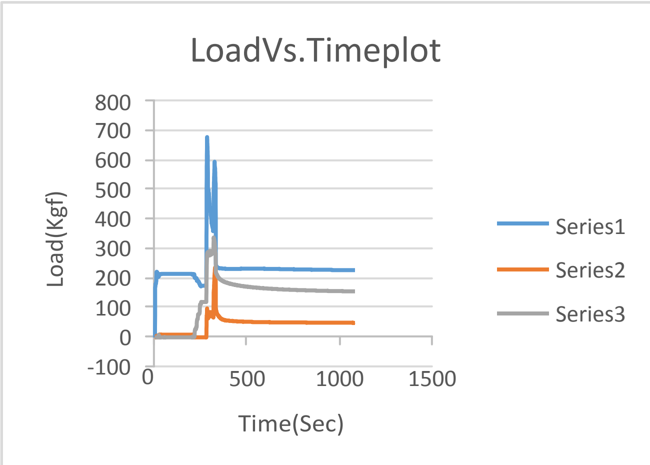


Figure7:loadsensorresultsbyexperimentalinvestigations

In this plot series 1 shows measurement of Plunge load, series 2 represents feed load and series s 3 presentstransferenceload.

From the plot we can present the phenomena of load distribution within the plates and fixture series 1represents the plunge load acting in vertical downwards direction. Pick what it achieve is for 2 pass. For first pass of weld the maximum load achieved is about 600kgf. The transverse load faced by plates is about300kgfandthefeedforcedeveloped duringplateisabout200kgf.
On basis of same the development of simplified fixture have been carried. And as a result this fixture isdeveloped.Presentedinfig. 4, 5and 7.

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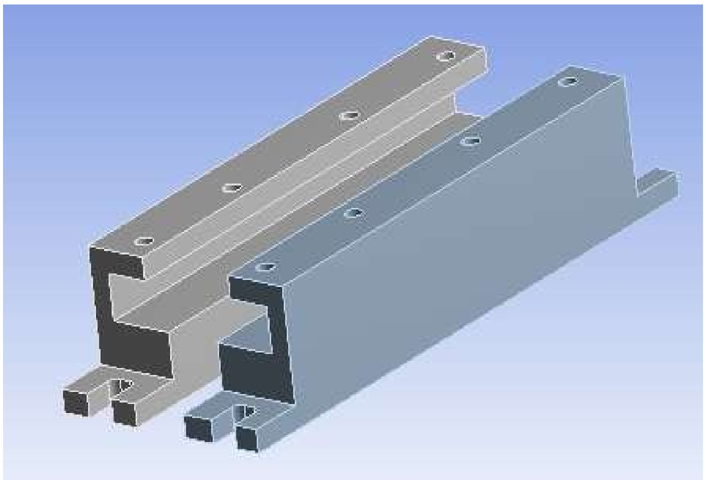

Figure4:3Dmodelofsimplifiedfixture forFSW.

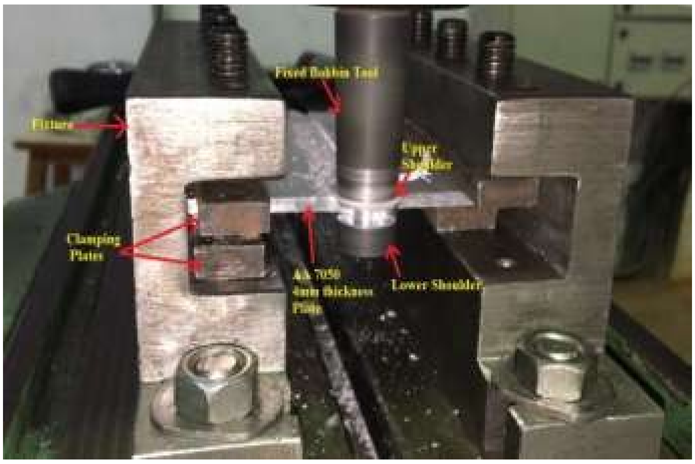

Figure5:Developed fixturewithbobbin toolweld application

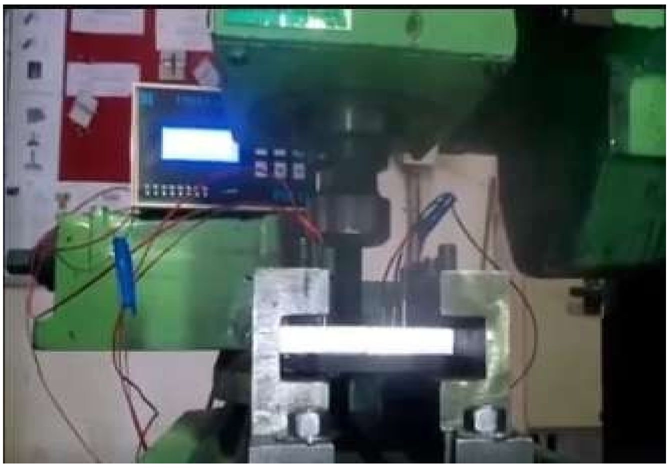

Figure6:developed fixturemodeland buttweld application

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RESULTSANDDISCUSSION:

The development phase have given load plots for plunge, feed and transverse direction. On basis of that thedesign thickness have been finalized. The draft have been tested with FEA software and then design havebeen acceptedwith major tolerances for variations in thickness.various set of experiments have been donetoobservetheloadingsonfixturebody.

CONCLUSION:

The design development have begun with concept and here solution is presented. The article also represents3 axis dynamometer to measure load on plate while performing FSW. The experimental study have givendirection to design a fixture with effective clamping of plate for processing/Welding of material with FSW.The developed design have been utilized to have trials for butt welding with FSW as well bobbin tool FSW.The developed design have shown improved as well flexible and cost effective solution to carry variousFSWoperationi.e.Buttweld,Lap Weld,Bobbintoolwelds.

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