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LOAD BEARING CHARACTERISTIC OF AL 6061 POLYMER COMPOSITE WHEN BONDED WITH DIFFERENT ADHESIVE SURFACE

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Abstract: Although composites have unmatchable mechanical properties when compared to traditional metals, composites are not open for some common applications due to their manufacturing cost. If one can identify a potential theory of composite manufacturing process then that will be the greatest achievement in the world composites and also highly advantage for the composite industry. Cost reduction in manufacturing process of composite materials is and will be the future scope for composite industry development. When a composite material member is subjected to impact loads or accidents, the bonding between the surfaces of the material fails and the two surfaces will acts as two individual material which leads to mechanical failure and design implications. Different polymers and adhesives were developed by the researchers; Composites are prepared in wide verities of combinations. This paper is presented based on the work done on the surface bonding of aluminum alloy 6061 with Polymethyl Methacrylate Polymer material. Primarily bonding is done with various adhesives based on their adherent properties chemical resistance, curing properties, electrical properties, mechanical properties, optical properties, thermal properties, other properties like acoustic, biocompatibility, environmentally friendly, fast curing, flame resistant, food safe, rework ability and viscosity. Taking study into the depth of the core, several surface preparation methods were studied and worked. Some of them were chemical, electric and mechanical surface preparation processes. During the bonding process an additional heat and pressure is applied to achieve air free surface bonding.In Addition to the above, work is concluded by testing the bonded joint in beam test under simply supported beam. The test piece is prepared for bond testing as per the guidelines of ASME and all the values were noted and interpreted according to the load vs displacement. And finally an analysis is carried on comparing the best manufacturing process, adhesive and surface preparation by plotting graphs obtained for different manufacturing processes, adhesives and surface preparations. In conclusion, from the result data the diamond knurling with acrylic adhesive gave best result when compared with various combinations.

Keywords: adhesives, al6061, Polymethyl Methacrylate, surface preparation.

INTRODUCTION:

Modern world is in need of a technology where weight is reduced, industry is concentrating on reducing weight of the unit in such an extent were they even finding alternative for mechanical fasteners. Several

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researchers are working on finding alternatives for mechanical joining methods; they found adhesive bonding and use of polymers so to decrease the thickness of the material. But they found huge resistance for bonding polymer with metals. Although it is a big task to overcome people are not losing their faith as they are getting some interesting results of bonding. this hard work is done will pay off soon once it is successful because this advanced technique of joining a metal and polymer has vast applications in the field of manufacturing, and structural. In modern day automotive design, operator and passenger safety are key considerations in the design process and they are major influences in structural design and material selection. As such safety devices and technologies, both active and passive are always evolving to ensure the safety of all aboard [1]. This evolution has also been greatly influenced by the industry's light-weighting drive where designers and engineers are seeking to increase motor vehicle's fuel economy and yet increasing safety and integrity of their vehicles in all aspects.[2] As is known vehicle occupant safety is at the greatest risk in the event of an accident and accidents occur in many different modes including rollover accidents, frontal impact, side impact and rear impact accidents and the key to protecting occupants in these encounters lies in ensuring the integrity of passenger compartments or safety cells so that other active safety devices such as seatbelts and airbags can perform their designed tasks effectively.[3]This paper will illustrate a work done on joining Al6061 with polymer by using different adhesives and different profiles.

PREPARATION OF SAMPLES

Initially the 2 mm aluminum sheet is sheared into designed dimensions of 280 X 30mm and visually tested, later the *work sample is cleaned thoroughly by salt paper grit no 80. Followed by, smoothening of the aluminum piece by* using emery paper, grit no. 220,320, and 600. A chemical agent of composition 94% of distilled water, 4% nitric acid, 2% of hydrofluoric acid is used to treat aluminum piece. After applying the chemical agent the test piece is send to the experiment. Several different profiles were machined on the aluminum test piece surface to perform experiments under different setups and conditions. In first experiment, the aluminum sheet surface is indented by diamond profile tool call knurling tool. This profile had been performed to improve mechanical interlocking so to get good bonding between two surfaces. This aluminum specimen is taken to work location there by it cleaned thoroughly followed by laying a thick layer of flexi wik gently throughout the aluminum surface. Then the work sample is subjected to compressive load for about 35 minutes to good bonding between the two surfaces.

DIMENSIONAL SPECIFICATION OF SPECIMENS

The entire specimens are same length; width and thickness of the specimens are 300mm, 50mm, 1mm

EXPERIMENTAL WORK

In finding the bonding strength between al 6061 with acrylic sheet several combinations were made and examined

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following are the combination we had designed in investigating the bonding between al 6061 and acrylic sheet.

EXPERIMENT 1

First experiment is done with only Al 6061 sheet and is trimmed to specified test dimensions and there been processed further in order to have a better bonding between two materials. In this process the Al 6061 is been subjected to diamond knurling in order to improve surface of the Al 6061. This is done to obtain high strength bonding and then bending test is been carried on the specimen and all the deflections were tabulated according to the applied load. The experiment specimen is illustrated below

Fig1 Aluminum 6061 diamond knurling

EXPERIMENT 2:

Second experiment is done with only acyclic sheet and is trimmed to specified test dimensions and there been processed further in order to have a better bonding between two materials and then bending test is been carried on the specimen and all the deflections were tabulated according to the applied load The experiment specimen is illustrated below.

Fig 2 Aluminum 6061 and acrylic sheet bonding (flexi kwik)

EXPERIMENT 3: In third experiment is done with Al 6061 sheet and acrylic sheet is trimmed to specified test dimensions and then they are bonded with a flexi kwik glue to good bonding. Before bonding the Al6061 sheet is been subjected to diamond knurling in order to improve surface of the Al 6061. This is done to obtain high strength bonding and then bending test is been carried on the specimen and all the deflections were tabulated according to the applied load. The experiment specimen is illustrated below. Technical illustration of this combination is Flexi kwik bond (D (AL) + S (P))

Fig 3 Aluminum 6061 and acrylic sheet bonding (flexi kwik)

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EXPERIMENT 4

In fourth experiment is done with Al 6061 sheet and acrylic sheet is trimmed to specified test dimensions and then they are bonded with a flexi kwik glue to good bonding. This is done to obtain high strength bonding and then bending test is been carried on the specimen and all the deflections were tabulated according to the applied load. The experiment specimen is illustrated below. Technical illustration of this combination is Flexi kwik bond (S (AL) +S(P))

EXPERIMENT 5

In fifth experiment is done with Al 6061 sheet and acrylic sheet is trimmed to specified test dimensions and then they are bonded with a Epoxy bond glue to good bonding. Before bonding the Al6061 sheet is been subjected to diamond knurling in order to improve surface of the Al 6061. This is done to obtain high strength bonding and then bending test is been carried on the specimen and all the deflections were tabulated according to the applied load. The experiment specimen is illustrated below. Technical illustration of this combination is Epoxy bond (D (AL) +S (P))

EXPERIMENT 6:

In sixth experiment is done with Al 6061 sheet and acrylic sheet is trimmed to specified test dimensions and then they are bonded with a Epoxy bond glue to good bonding. This is done to obtain high strength bonding and then bending test is been carried on the specimen and all the deflections were tabulated according to the applied load. The experiment specimen is illustrated below. Technical illustration of this combination is Epoxy(S (AL) +S (P))

Fig 4 All bonding sheets

All the bonding sheets are shown in the above figure

5.3 Testing sheets specification

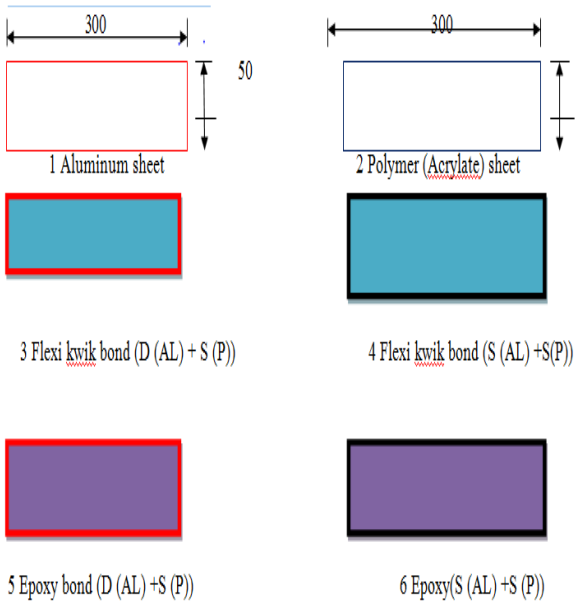

Fig 5 All sheets with their specifications

NOTE: "S" is smooth surface "D" is diamond surface "AL" is aluminum 6061 sheet "P" is polymer

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5.4 Test performed: Deflection test

*NOTE: All deflection values are in mm

SL NO	LOAD IN KGS	SPECIMEN 1	SPECIMEN 2	SPECIMEN3(D(AL)+S(P))	SPECIMEN4(S(AL)+S(P)	SPECIMEN5(D(AL)+S(P)) EPOXY BOND	SPECIMEN6(S(AL)+S(P))
		ALUMINIUMSHEET	POLYMER(ACRYLATE)SHEET	FLEXIKWIK BOND	FLEXIKWIK BOND		EPOXY BOND
1	1	2.81	5.3	1.17	1.09	0.75	1.01
2	2	4.48	11.6	2.15	2.22	1.85	2.03
3	3	6.93	16.3	3.11	3.59	2.89	3.09
4	4	9.24	18.3	3.94	5.08	3.94	4.92
5	5	12.89		4.85	6.55	5.98	5.89
6	6	14.39		5.68	7.98	6.99	6.85
7	7	16.51		6.41	9.39	7.23	7.79
8	8	20.23		7.15	10.56	9.97	8.71
9	9			7.94	11.96	10.29	9.64
10	10			9.13	12.18	10.73	10.71
11	11			9.97	13.32	11.74	11.72
12	12			10.78	15.15	11.91	12.82
13	13			10.99	16.81	14.24	13.91
14	14			11.9	18.56	15.35	15.09
15	15			11.99	20.45	16.74	16.02
16	16			12.87	21.68	16.97	17.31
17	17			13.18	22.61	17.79	18.42
18	18			13.42	25.51	18.19	19.87
19	19			14.21	30.31	22.21	21.52
20	20			15.08		23.11	23.21
21	21			16.45		26.29	24.22
22	22			16.99			27.16
23	23			17.36			
24	24			18.77			
25	25			22.78			
26	26			24.71			

Table 1: Test results

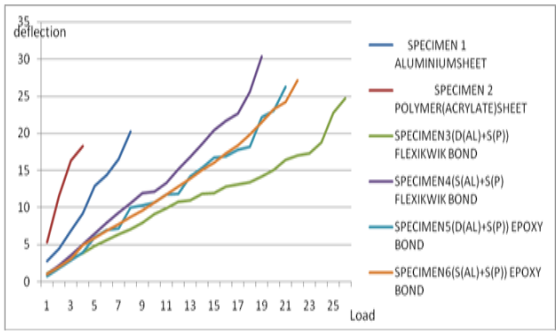

Chart 1 Load vs Deflection chart

Specimen	Load (kg)	Deflection (mm)	Weight (kg)
SPECIMEN 1 ALUMINIUMSHEET	8	20.23	0.07
SPECIMEN 2 POLYMER(ACRYLATE)SHEET	4	18.3	0.05
SPECIMEN3 (D(AL)+S(P))	26	24.71	0.124
SPECIMEN4 (S(AL)+S(P)	19	30.31	0.12
SPECIMEN5 (D(AL)+S(P)) EPOXY BOND	21	26.29	0.118
SPECIMEN6 (S(AL)+S(P)) EPOXY BOND	22	27.16	0.12

Table 2: Summary of specimen results with their weights.

CONCLUSION

Every aspect of this project has been interesting throughout. Concluding a project doesn't just simply, the project ending without serving a purpose that it should be. Conclusion includes all the summary of a project which may have in them the literature survey, procurement of raw material, machinery for manufacturing and feasibility studies.It becomes very important to check the latest arrivals order to meet the industrial needs. Hence i suppose my project could provide an intimate study regarding the manufacturing technologies and their processes for those who try to establish an unaccounted growth of their organization.As discussed above, various driving forces are leading numerous companies that have

relied upon standard joining methods such as welding, brazing, rivets and bolts in the past; to consider the use of high performing toughened structural adhesives. Such adhesives can provide significant advantages in terms of overall cost and weight reduction, as well as the ability to join dissimilar substrates and the ability to create joints with good stress distribution and concomitantly good fatigue and force resistance. Toughened adhesives can also improve aesthetics and eliminate labor-intensive finishing costs such as sanding off slag from spot welding. Choosing the right adhesive is paramount and engineers should work closely with their material supplier to select the right product. In addition, some joint redesign and production processing adjustments may greatly affect ultimate project success. However, as can be demonstrated empirically, when used properly structural adhesives can meet or exceed the performance of traditional joining methods such as welding, rivets and bolts.Aluminium6061 and polymers are bonded simply without any external agent for strength analysis, if adhesives are added as bonding agent aluminum and polymers will give more strength.

REFERENCES

[1] K. V. Mutya and S. Rudra, “Road Safety Mechanism to Prevent Overtaking Accidents,” *International Journal of Engineering Trends and Technology,* vol. 38, p. 219 – 222, 2015

[2] E. Ghassemieh, "Materials in Automotive Application, State of the Art and Prospects," in *New Trends and Developments in Automotive Industry*, M. Chiaberge, Ed., Rijeka, INTECH, 2011, pp. 365-394.

[3] S. . L. Oesch, "Statement before the US Senate Committee on Commerce, Science, and Transportation: IIHS research on vehicle roof crush,"