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COMPARISON STUDIES OF POTTERY CLAY ADHESIVE AND LOCTITE

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ABSTRACT
The present study focused on the shear strength of the lap joint specimens prepared using adhesive of clay particle size of 45 microns and 75 microns. Further the study analyzed the shear strength of lap joint specimens prepared using adhesive of clay particle size of 45 microns and superior loctite 40025.

INTRODUCTION
Adhesive may be used interchangeably with glue, cement, mucilage, or paste. It is the substance applied to one surface, or both surfaces, of two separate items that binds them together and resists their separation. Epoxies are adhesive systems made by a complex chemical reaction. Various resins are made synthetically by reacting two or more chemicals. The resultant resin can then be reacted or cured by the addition of another chemical called a hardener, or catalyst. Pottery Clay, being relatively impermeable to water, is also used where natural seals are needed, such as in the cores of dams, or as a barrier in landfills against toxic seepage (lining the landfill).

LITERATURE REVIEW
He and Oyadiji (2001) found that the transverse natural frequencies of the single lap joint cantilever beams increase with increase of young's modulus of adhesive but does not change significantly with increase of poisson's ratio. Stiffer adhesive is more prone to fatigue failure than softer adhesive.

Davies and Sohier (2009) examined the physico-chemical and mechanical behaviour of aluminium substrates bonded with epoxy adhesive joints of different thicknesses. There is no evidence that changing the joint thickness results in significant modifications to the polymer structure, the interface region nor the presence of defects for this assembly, over the range from 0.2 to 1.3 mm. For adhesively bonded aluminium assemblies tested using the modified Arcan fixture a small influence of bond line thickness was noted under shear and tension/shear loads; a small reduction in mechanical properties was noted as bond line thickness was increased.

Prashant Sudiranjan Rade et al. (2013) developed a mathematical model for optimized joint conditions ensuring maximum shear strength for different lap joints.

Kadam et al. (2015) found that, for the same adhesive thickness and material properties the stress induced is directly proportional to the load applied. As stress induced has negative effect on the joint strength, the strength of the joint is decreased with the increase in the adhesive thickness. Further it is observed that the finite element predictions for Von Mises stresses agree well with the experimental results.

Silva et al. (2016) undertook a study of various mixed joints configuration under static and impact conditions. A new experimental technique was developed to manufacture Single Lap Joint with mixed adhesive layers with a minimum amount of defects. The use of a ductile adhesive at the ends of the overlap combined with a brittle adhesive, such as the combination of DP-8005 and AV138, improves the maximum strength of the joints in quasi-static tests. The tests also demonstrated that the mixed adhesive technique increases with the use of longer overlaps, especially when a ductile adhesive is combined with a very stiff one. Impact tests revealed that this type of improvement also happens under high strain rates, where the mixed configuration of DP-8005 and AV138 achieved an even higher increase in joint strength for impact conditions.

METHODOLOGY

Preparation of specimen

- Preparation of Pottery clay adhesive : - Manual mix method
- Weight the pottery clay , Araldite AW106, Hardener HV 953 U and Epoxy paint hardener as per the required percentage using weighting balance.
- Keep aside for mixing.
- Pour the weighted pottery clay on the plate.
- Add AW106 and hardener into it.
- Start mixing by manually using putty scraper thoroughly until it mixed.
- Add epoxy paint hardener into it and mix thoroughly for some time.
- A proper mixture appeared with solid viscous in nature.
- The mix is ready to use.
- Curing is done at room temperature for a period of 16 hours.

ASTM D-1002 test procedure

ASTM D-1002 determines the shear strength of adhesives for bonding metals when tested on a single-lap-joint specimen. Two metal plates are bonded together with adhesive and cured as specified. The assembly is then cut into uniform width lap shear specimens. The test specimens are placed in the grips of a universal testing machine and pulled at 1.3 mm/min (0.05 in/min) until rupture occurs. The grips used to secure the ends of the assembly must align so that the force is applied through the centerline of the specimen. The type of failure can be either adhesive (the adhesive separates from one of the substrates) or cohesive (the adhesive ruptures within itself).

Specimen size

The recommended lap shear specimen is 25.4 mm (1”) wide, with an overlap of 12.7 mm (0.5”). The recommended metal thickness is 1.62 mm (0.064”) and the overall length of the bonded specimen should be 177.8 mm (7”). The specimen failure should occur in the adhesive, and not in the substrate – thus the metal thickness and the length of the overlap may be adjusted as necessary. Adhesive is applied based on manufacturer recommendations.

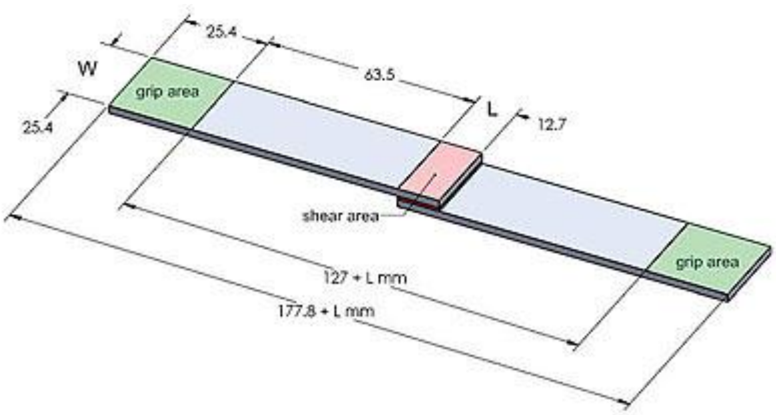

Figure 1. Sample specimen diagram.

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Table I. Lap shear strength of samples prepared from 75 micron clay particle size.

	Sl. No.	Bonding Length (mm)	Bonding Width (mm)	Load at failure (Kgf)	Shear Strength (Mpa)
Pottery Clay particle size (75 micron)	1	12.9	25.6	213.1	6.33
	2	12.84	25.22	254.3	7.70
	3	12.9	25.4	254.5	7.62
	4	12.8	25.63	229.84	6.87
	5	12.9	25.23	223.61	6.74

Table II. Lap shear strength of samples prepared from 45 micron clay particle size.

	Sl. No.	Bonding Length (mm)	Bonding Width (mm)	Load at failure (Kgf)	Shear Strength (Mpa)
Pottery Clay particle size (45 micron)	1	12.7	25.2	325.4	9.97
	2	12.9	25.35	330.35	9.91
	3	12.8	25.5	328.9	9.89
	4	13.18	25.2	321.88	9.51
	5	13.1	24.8	307.16	9.27

RESULTS AND DISCUSSION

- From the Table I it has been inferred that Average Lap shear strength is 7.05 Mpa for 75 micron clay particle size.
- From the Table II it has been inferred that Average Lap shear strength is 9.71 Mpa for 45 micron clay particle size.
- From the results it has been found that there was improvement in lap shear strength when the sieve size of clay particle is reduced from 75 microns to 45 microns.

Table III. Lap shear strength of samples prepared from Loctite Superior 40025

	Sl. No.	Bonding Length (mm)	Bonding Width (mm)	Load at failure (Kgf)	Shear Strength (Mpa)
Loctite Superior 40025	1	12.73	25.4	280.2	8.50
	2	12.55	25.7	269.3	8.19
	3	12.32	25.89	279.55	8.60
	4	13.1	25.8	306	8.88
	5	12.6	25.1	92	2.85

Table IV. Lap shear strength of samples prepared from 45 micron clay particle size.

	Sl. No.	Bonding Length (mm)	Bonding Width (mm)	Load at failure (Kgf)	Shear Strength (Mpa)
Clay adhesive (45 micron)	1	12.5	25.4	320.22	9.89
	2	12.7	25.5	331.02	10.03
	3	12.6	25.7	347.55	10.53
	4	12.7	25.76	348.92	10.46
	5	12.75	25.53	365	11.00

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RESULTS AND DISCUSSION

- From the Table III it has been inferred that Average Lap shear strength is 7.41 Mpa for Loctite Superior 40025.
- From the Table IV it has been inferred that Average Lap shear strength is 10.38 Mpa for clay adhesive with 45 micron clay particle size.
- From the results it has been found that clay adhesive is having more lap shear strength when compared with Loctite Superior 40025.

CONCLUSION

- The study found that there was improvement in lap shear strength when the sieve size of clay particle is reduced from 75 microns to 45 microns.
- Pottery clay adhesive is having better lap shear strength when compared with Loctite Superior 40025.

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