IMPROVING THE RIGIDITY OF SHEET METAL BY EMBOSSING

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ABSTRACT

Embossing and restoration technique is conducted as a simple method to strengthen sheet metals. Soft aluminum, mild steel and stainless steel sheets of different thickness are subjected to embossing and restoration at different sheet patterns and emboss height. Deflection tests are then conducted to evaluate the effects of the parameters considered on the increase in the rigidity of sheets. Experimental is employed in the investigation. Results show that the restoration technique is effective in increasing the rigidity of thin sheet metals. By taking into considerations several important parameters, improvement in rigidity can be enhanced as shown in this study. Also, it should be emphasized that this technique can be used not only for increasing the rigidity of sheet metals but also for making decorative sheets without any special forming tools.

Keywords: sheet metal forming; restoration; embossing; FEM simulation; rigidity.

I.INTROUDCTION

Sheet metal forming is one of the most important and commonly practiced fabrication processes on the manufacturing industry, ranging from the production of car body, outer panel of electric products and appliances, metal furniture and structural panels. Through the years several efforts have been made in the sheet metal industry to improve efficiency and savings on energy and resource through reduction in weight and cost of the sheet metal product .For instance in the automotive industry the use of lighter gauge high strength steel alloy new density aluminum alloys and tailor welded blanks provided promising opportunities in reducing overall body weight and increasing mileage performance. The use of thinner sheets is practical way for reduction of product cost and product weight. However in utilizing a lighter grade conventional sheet metal during press forming some problems such as increase in deflection due to its low rigidity and strength arise Moreover the formability of the sheet also decreases with decreasing sheet thickness with the objective of overcoming theses drawbacks restoration technique has been proposed to strengthen sheet metal through simple means the sheet metal is bulged by punch and then the embossed sheet is compressed between flat tool.

II. SHEET METAL

Sheet metal is metal formed by an industrial process into thin, flat pieces. Sheet metal is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes. Countless everyday objects are fabricated from sheet metal. Thicknesses can vary significantly; extremely thin sheets are considered foil or leaf, and pieces thicker than 6 mm (0.25 in) are considered plate.

Sheet metal is available in flat pieces or coiled strips. The coils are formed by running a continuous sheet of metal through a roll slitter.

III. MECHANICS OF SHEET METAL STAMPING

Mechanics of cutting sheet metal should be understood when designing a press working manufacturing process. The work piece in a sheet metal cutting operation is secured to the lower die, whiles the motion of the upper die, (called a punch), and enacts the cutting. Edges of the punch and die do not line up precisely, due to a *clearance* or space between them. The punch is designed to enter the matching hole in the lower die and is always at least a little smaller. Clearance size, in sheet metal cutting, will vary with different process factors and its selection will affect the quality of the manufactured part.

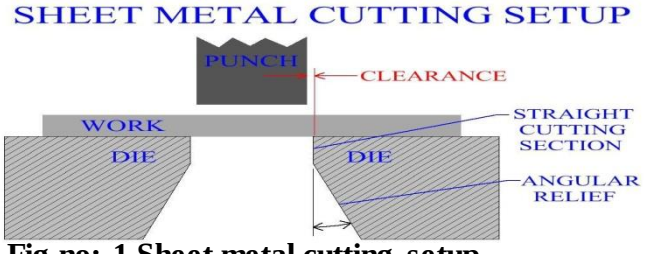


Fig no: 1 Sheet metal cutting setup

As the cutting process begins, force enacted through the punch causes it to move toward the work. The sheet metal is secured to the lower apparatus, it does not move when contacted by the punch. Instead, pressure builds up between the punch and sheet. Plastic deformation of the surface metal occurs. This happens at the top and bottom surfaces, since the bottom cutting die is pushing up with the same force that the punch is pushing down. In manufacturing practice, the plastic deformation occurring at the surfaces of the sheet metal, at this stage in the cutting operation, is referred to as rollover.

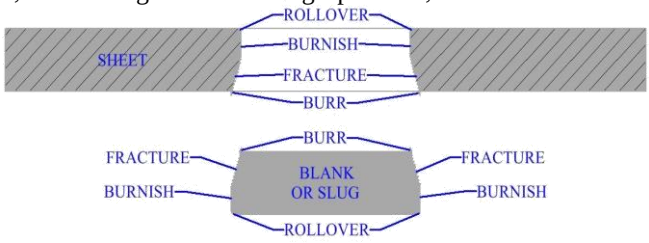


Fig no: 1.2 Cut Profiles of Hole and Blank

IV. DESIGN IN CATIA

SHEET DIMENSIONS 1000*500MM

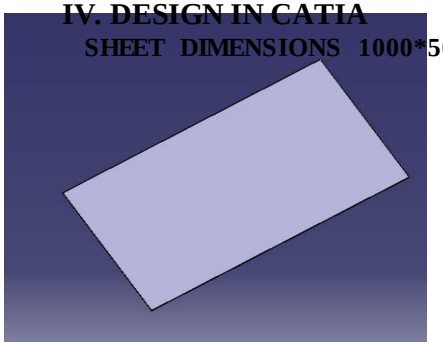


Fig no: 4.1 Plain sheet

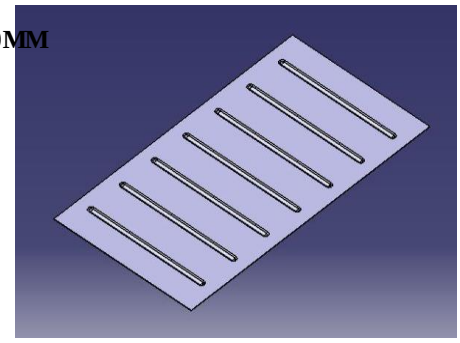


Fig no: 4.2: Embossment 1

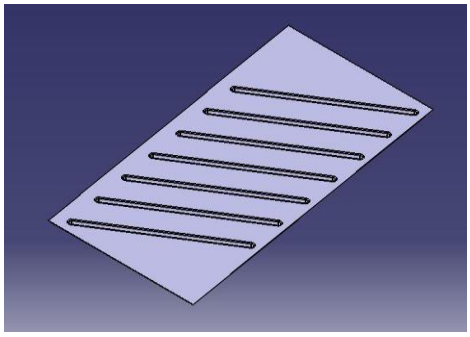


Fig no.4.3: Embossment 2

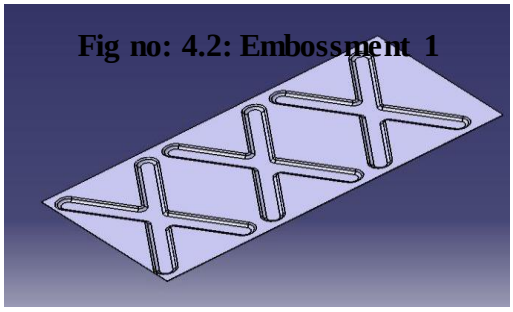
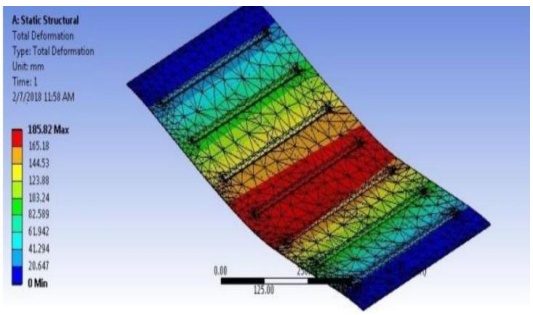
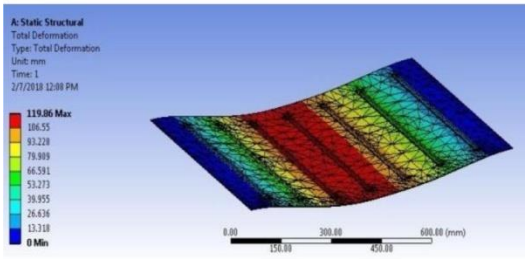


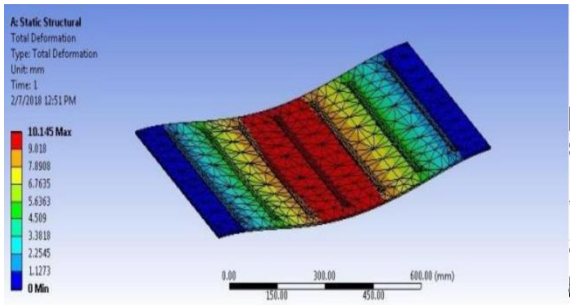
Fig no: 4.1 Embossment 3

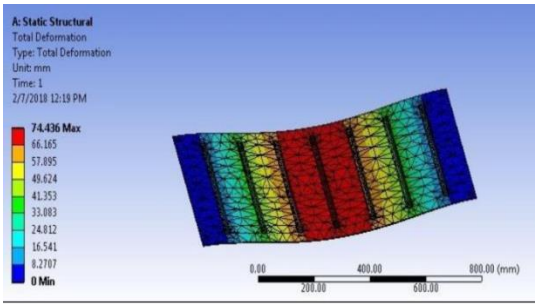
V. ANALYSIS

5.1 ALUMINUM 5.1.1 Embossment 1 With thickness 1.82, 2.3, 2.05, 2.9, 5.82

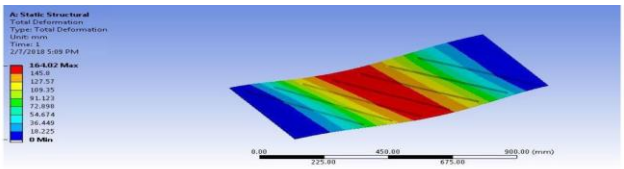


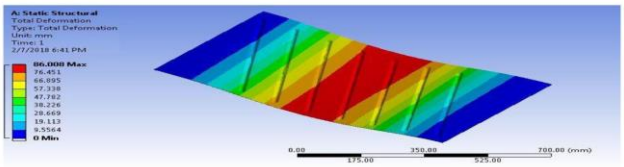


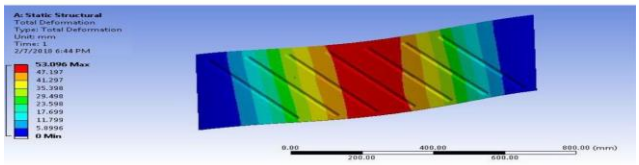


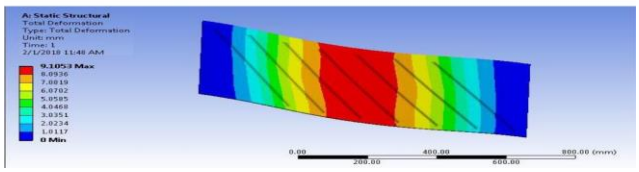


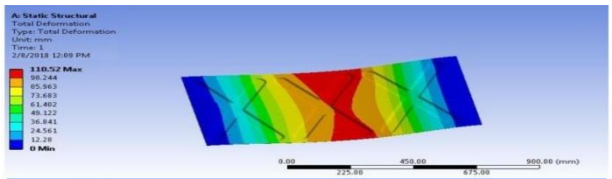
5.1.1Embossment 2 With thickness 1.45, 2.3, 2.9, 5.82 5.13.3

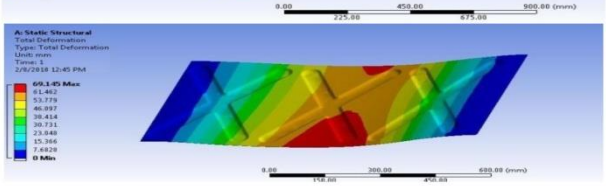


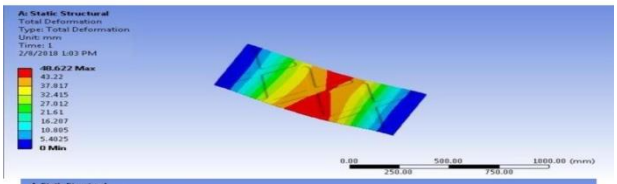


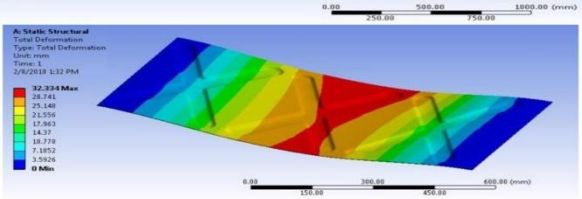








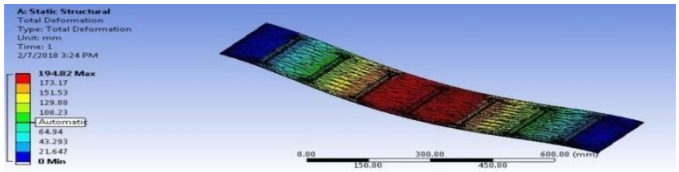


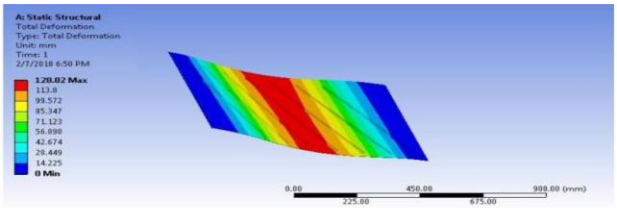


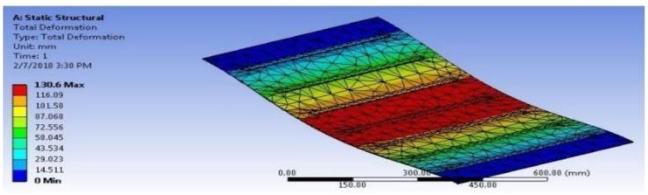
5.2 GALVANIZED STEEL

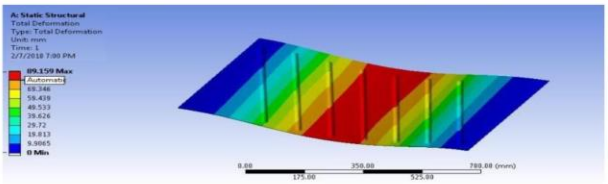
5.2.1 Embossment 1With thickness 2.37, 2.75, 3.13, 3.89

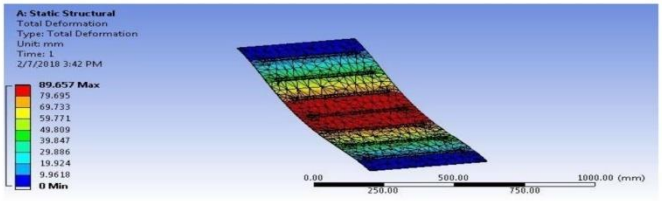
5.2.2 Embossment 2 With Thickness 2.37, 2.75, 3.13, 3.89

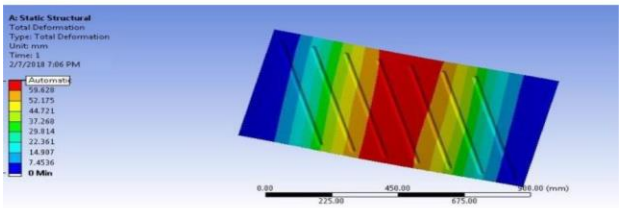


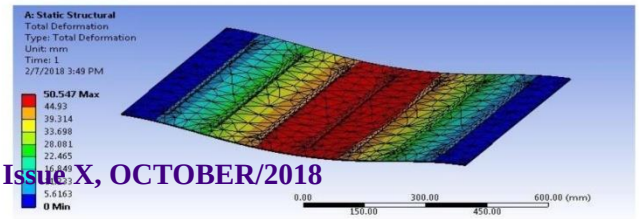


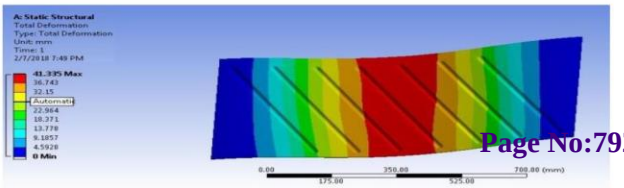




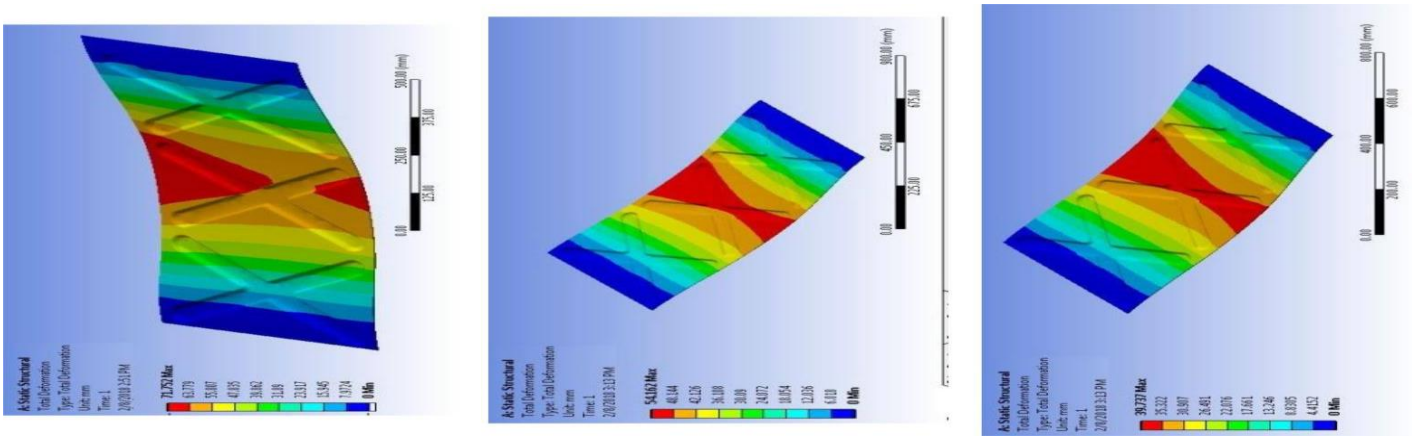






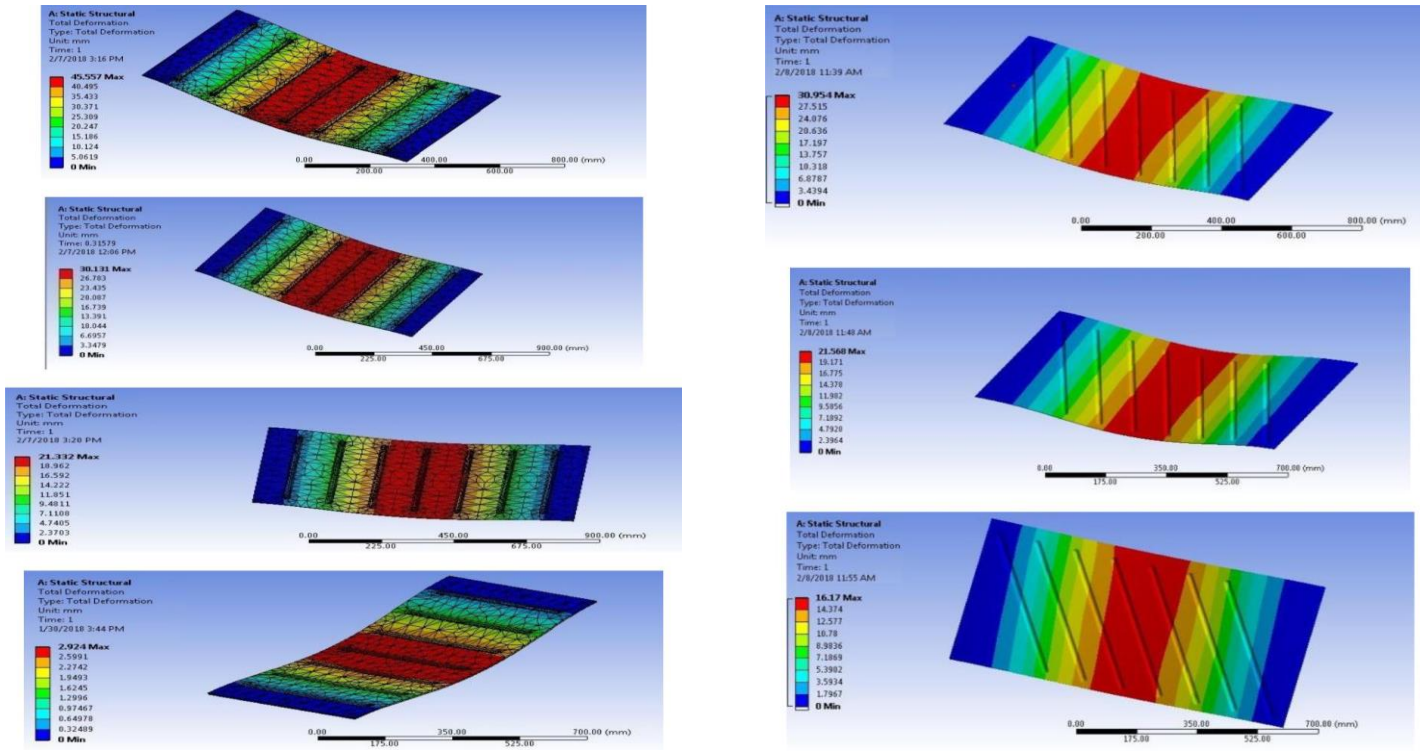


5.2.3 Embossment 3 With thickness 2.37, 2.77, 3.13

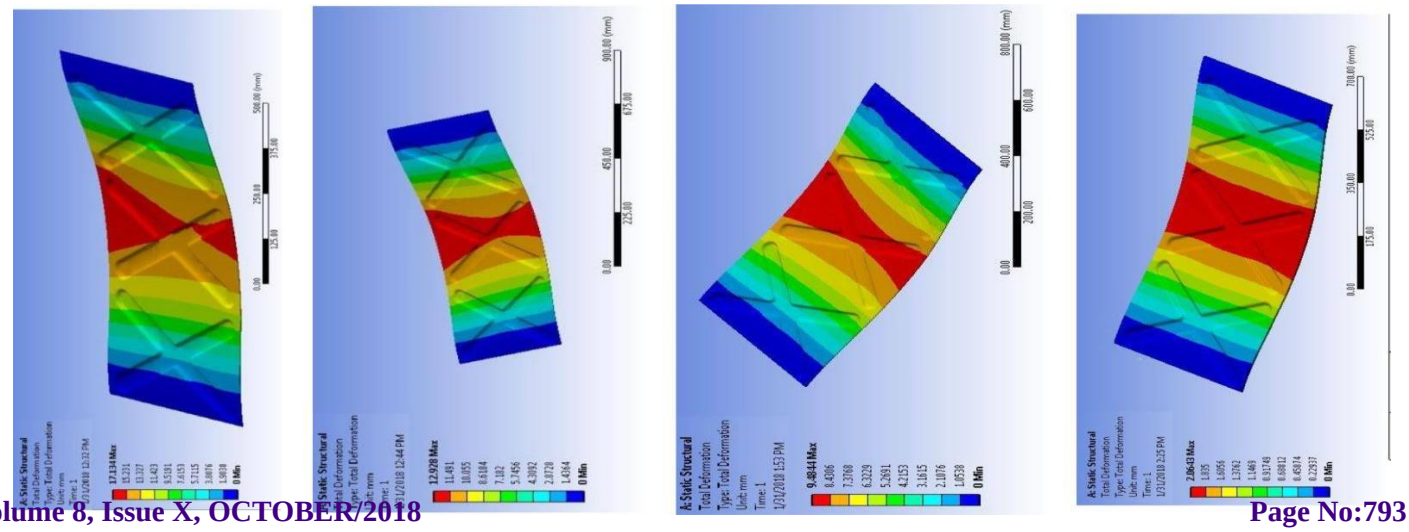


5.3 STAINLESS STEEL

5.3.1 Embossment 1With thickness 2.88, 2.77, 3.17, 6.35 **5.3.2 Embossment 2With thickness 2.38, 2.77, 3.13, 3.96, 6.35**



5.3.3 Embossment 3 With thickness 2.38, 2.77, 3.17, 6.35



VI RESULTS

	STAINLESS STEEL				
Gauge	Thickness	Plain sheet	Embossment 1	Embossment 2	Embossment 3
(ga)	mm	Def(mm)	Def(mm)	Def(mm)	Def(mm)
3	6.35	3.04	2.92	2.66	2.06
9	3.96	**10.67**	9.26	9.91	6.27
11	3.17	24.3	21.3	16.17	**9.48**
12	2.77	38.9	30.13	21.5	12.92
13	2.38	55.95	45.5	30.9	17.13

	GALVANIZED STEEL				
Gauge	Thickness	Plain sheet	Embossment 1	Embossment 2	Embossment 3
(ga)	mm	Def(mm)	Def(mm)	Def(mm)	Def(mm)
3	0	0	0	0	0
9	3.89	55.02	50.54	41.33	26.3
11	3.13	101.58	89.65	67.08	39.73
12	2.75	164.37	130.6	89.15	54.16
13	2.37	233.72	194.5	128	71.75

	ALUMINIUM				
Gauge	Thickness	Plain sheet	Embossment 1	Embossment 2	Embossment 3
(ga)	mm	Def(mm)	Def(mm)	Def(mm)	Def(mm)
3	5.82	10.59	10.1	9.1	6.9
9	2.9	85.4	74.43	53.99	32.33
11	2.3	171.2	119.96	83.608	48.622
12	1.82	241.7	169.311	125.84	69.145
13	1.42	300.2	185.82	164	110.52

VII CONCLUSION

Experimental investigations are conducted to various sheet metals subjected to embossing and restoration .Results show that the proposed technique is an efficient way to improve the rigidity of thinner sheet metals, which leads to the reduction of formed parts. Furthermore, he improvement can be enhanced by taking into consideration several parameter .It should also be emphasized that this technique can be used not only for increasing the rigidity of sheet metals but also for making decorative sheets without any special forming tools.

VII REFERENCE

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