

Study of Mechanical Properties of Metal Matrix 150 Microns of Red Mud

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ABSTRACT

Al6061 is referring to the class of light weight high performance centric material systems. The reinforcement in Al6061 matrix composites could be in the form continuous / discontinuous fibers or particulates in volume fractions. This work focus on the fabrication of Al6061 Alloy matrix composites reinforced with 0%, 12%,14%,16%,18%,20 wt% Red Mud of 150micron using stir casting. Material is melt in furnace at 750⁰C temperature. After the completion of process pre –heat the casted specimen in the furnace at 350⁰C temperature for a half-hour to reduce the porosity and also increase the strength. The mechanical properties of fabricated AMCs were analyzed .i.e. tensile strength, hardness and also microstructure study. Thus the tensile strength and hardness have improved with the increase wt% of RM in Al6061 Alloy.

Key words: Al6061, Red Mud, Stir Casing, preheating

1. Introduction

1.1 6061 Aluminum Alloy

Aluminum is a precipitation hardening aluminum, containing magnesium and silicon as its most important alloying elements. Originally called "Alloy 61S," it became advanced in 1935. It has right mechanical houses and reveals right weld ability. It is one of the maximum not unusual place alloys of aluminum for widespread motive use. It is usually to be had in pre-tempered grades consisting of 6061-O (annealed.)

Al alloy Al 6061 is broadly utilized in several engineering packages consisting of shipping and creation wherein advanced mechanical homes which includes tensile strength, hardness etc., are basically required. A standard chemical composition of Al 6061 advanced corrosion resistance makes it an appropriate candidate fabric for marine structural packages.

1.2 Red Mud

The crimson dust used for the prevailing research changed into delivered from the close by mining ore the scale of the dirt changed into measured with the aid of using the use of a sieve. As in keeping with this evaluation the common length of the dirt changed into one hundred fifty micron. (150 micron) [2]

1.3 Compositions of Al6061+RM

Table-1 Composition of Al+RM

Sl.No	Material Compositions
01	Pure Aluminum of 6061
02	Aluminum of 6061+12% of RM
03	Aluminum of 6061+12% of RM
04	Aluminum of 6061+12% of RM

05	Aluminum of 6061+12% of RM
06	Aluminum of 6061+12% of RM

Increase within side the weight fractions of the fly ash debris will increase the final tensile energy, compressive energy, hardness and reduces the ductility of the composite.[1] The alloy is likewise used wherein resistance to corrosion is an critical attention especially wherein high strength is likewise required[2] The particle size, extent fraction, shapes of the debris very a good deal affects the mechanical homes of composite materials[3] The micro structural homes analyzed the usage of SEM and EDAX suggests appropriate bonding among the reinforcements and steel matrix composite [4] Tensile strength and compressive strength increased by adding Sic & Gr Al6061 both alloys.[5] Objectives To increase reinforcement of Aluminum matrix with using red mud. To look at the mechanical residences of the evolved composites. To look at the microstructure residences of the evolved composites via way of means of Image analyzer

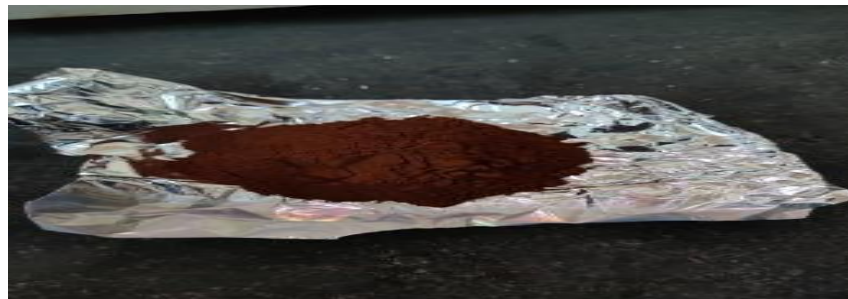


Fig-1 Red Mud.

2. Method

2.1 Experimental work

In experimental work first we have done the sieve analysis red mud of 150 micron as shown in fig-2. We melt the molten metal of Al 6061 alloy in electrical furnace at 750⁰c of temperature as shown in fig -3 then we add different % of red mud into it .we have mix the composition by using stir casting method as shown in fig-4 and also we add cover flux and degasser because in order to remove dirty particles from the materials. Pour the molten metal into the die as shown in fig-5 than finally casted specimen are ready as shown in fig -6 Preheat the casted specimen in furnace at 350⁰C temperature for an half hour as shown in fig-7 then we have prepare the tensile ,hardness, microstructure specimen with required dimensions. As shown in fig-8, fig-9, fig-10



Fig-2 Sieve Analysis Red Mud of 150 Micron.



Fig-3 melting process



Fig-4 stirs casting.



Fig-5: pouring process



Fig-6: preheating.



Fig-7: Casted



Fig -8: Tensile



Fig-9 Hardness



Fig-10
Microstructure

3. Result and Discussions

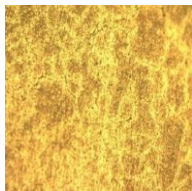


Fig-11 pure Al6061.



Fig -12 Al+12%RM.



Fig -13 Al+14%RM.

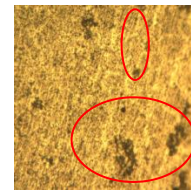


Fig -14 Al+16%RM.

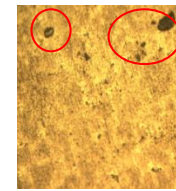


Fig -15 Al+18%RM.

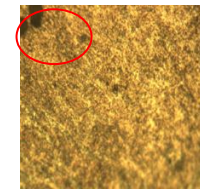


Fig -16 Al+20%RM.

The microstructure study starts with the optical microscopy. All the casted samples after polishing have been studied using image analyzer to observe the microstructure. The fig -11 of pure al6061 alloy without addition of reinforcement of red mud the grain size in the pure al6061 alloy are in smaller size and the grain are complex in nature and this image are captured by 1000X magnifications.

The microstructure study starts with the optical microscopy. All casted samples after polishing have been studied using image analyzer to observe the microstructure. The above figs -12, 13,14,15,16 shows the microstructure of the material the dispersion of 12%, 14%, 16%, 18%, 20% of red mud is varied depending upon the wt% of the red mud .the volume fraction of the red mud is increased as the wt% is increased, the grain size of the red mud is also increases as shown in above figs these image are captured by 1000X magnifications.

3.2 Tensile Results

The below graph showing the variation result of ultimate tensile strength versus different weight percentage of red mud reinforced with the metal matrix composites From the observation, it is clear that increase in the %of the red mud into the metal matrix composites increases the ultimate tensile strength of the composites. The tensile strength is creased from **102.07 MPa** to **215.87 MPa**.

Table: 2 Tensile and % of elongation.

Material composition	UTS (MPa)	% Elongation	Load (KN)
Base pure Al6061	102.07	9.5	5.13
Al6061+12%RM	125.02	8.69	6.28
Al6061+14%RM	154.08	7.812	7.74
Al6061+16%RM	174.78	7.131	8.78
Al6061+18%RM	189.21	6.947	9.51
Al6061+20%RM	215.87	6.782	10.85

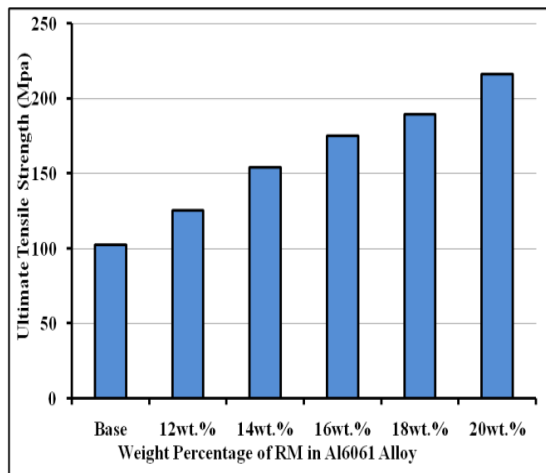


Fig-17- UTS/%wt of RM in 6061 alloy.

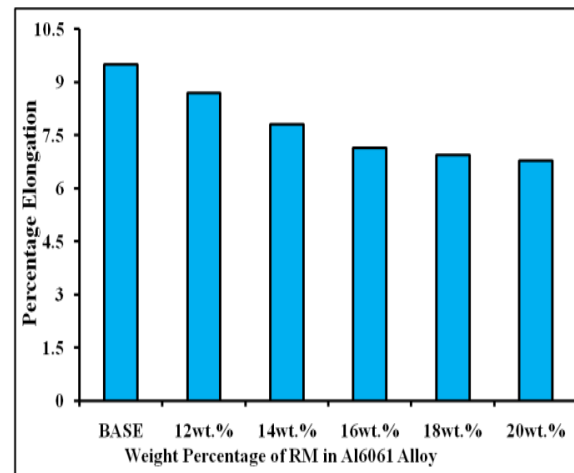


Fig-18 %E/%wt of RM in 6061 alloy.

The above graph showing the variation result of % of elongation versus different weight percentage of red mud reinforced with the metal matrix composites. From the observation, it is clear that, increase in the % of the red mud into the metal matrix composites decreases the % elongation of the composites. The % of elongation is decreases from **9.5 to 6.75**

3.3Vickers Hardness Test Result

Table:3 Vickers hardness result

Material composition	LOAD F (Kgf)	Diagonal length of indentation d (mm)	HV= $1.8544/d^2$ (kgf/mm ²)
Base pure Al6061	30	0.812	84.2
Al6061+12%RM	30	0.715	108.5
Al6061+14%RM	30	0.703	112.3
Al6061+16%RM	30	0.676	121.03
Al6061+18%RM	30	0.648	131.85
Al6061+20%RM	30	0.624	142.68

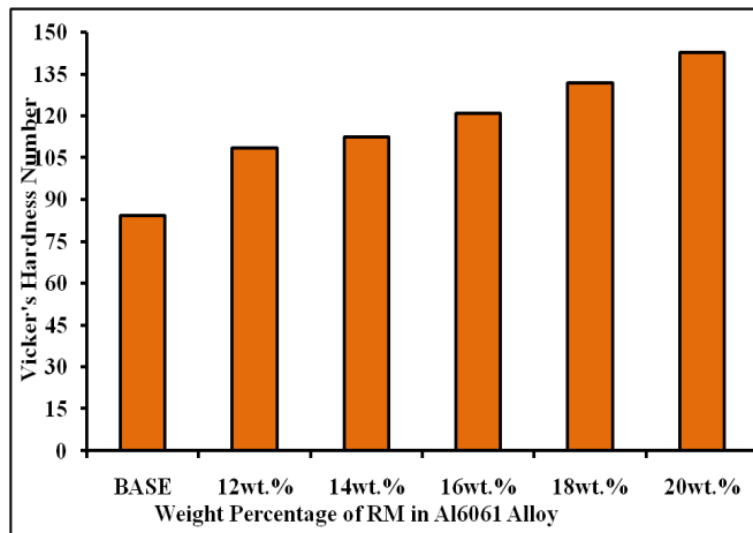


Fig 19- HV/%wt of RM in 6061 alloy.

The above graph showing the variation result of Vickers hardness number versus different weight percentage of red mud reinforced with the metal matrix composites. From the observation, it is clear that, increase in the % of the red mud into the metal matrix composites increases the Vickers hardness number of the composites. Vickers hardness number is increases from **HV 84.2 to 142.68 HV**

4. Conclusion

Based at the experiments carried out to investigate the consequences of Al6061 with the aid of using including numerous weight % fractions of Red dust the subsequent conclusions may be made Aluminum– primarily based totally MMCs containing Al6061-Redmud have been efficaciously fabricated with the aid of using stir casting technique with pretty uniform distribution of RED dust. The tensile– electricity in Al6061+ Red mud is located to boom with boom in RM weight percent, higher tensile electricity changed into determined in Al6061+ with Red dust samples. Al6061+redmud put on microstructure increases with boom in RM wt % content higher grain size in Al6061+RM samples.

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