ISSN 2303-4521
Periodicals of Engineering and Natural Sciences *Original Research*
Vol. 10, No. 3, June 2022, pp.323-333

A comparative study using silicon carbide and zirconium dioxide nano material's to improve the mechanical properties of 6261AA

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ABSTRACT

The applications of nanotechnology differ in different areas of life. Despite all the advantages of nano-materials, there are many difficulties that need further research the most important of which is obtaining cheap, practical materials with appropriate specifications for use in various applications. This study examines the addition of multiple proportions of two materials (Silicon Carbide and Zirconia) to 6261 Aluminum alloy. Results were obtained stating that using the two nano-materials together is better than using each one separately. The best ultimate tensile strength (UTS)waders were obtained at (1.5-2.0 wt%) ratios ranging. 1.5% wt. of ZrO_2 and (%SiC+% ZrO_2). The improvements were (75.1 %) and (92 %) respectively. The UTS improvements (84.3%) for Al/ 2.0wt. %SiC. Also, a significant improvement was seen in the hardness values for all the weight ratios of the nano-additives with respect to the base alloy. The percentage of ductility has decreased after adding nano-materials.

Keywords: Nanomaterial, Nano composite, 6261AA, SiC, ZrO_2, Aluminum composite.

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1. Introduction

Aluminum is a lightweight metal, and its color varies between dull white and silver. It is the most abundant metallic element on the earth's crust, although it is not found at all in the form of a free metal. Rather, it exists in the form of separate compounds in nature, but it is abundantly available, especially in volcanic rocks; In the 60s of the last century it came at the top of the abundance of world production of the metal, outperforming copper. Aluminum oxide in the form of a solid film on its surface, which makes it resist corrosion in an excellent and use cathode protection effective way, aluminum is used widely, aluminum is used in window and door frames as one of its most popular uses, and in a wide range within industries and construction uses, and aluminum is used in the production and manufacture of beverage and canned food cans, Aluminum also enters the manufacture of waterproof fabrics, and aluminum compounds can be used in the manufacture of insulation materials, and in the manufacture of cars and spark plugs, in addition to the importance of using aluminum in the manufacture of aircraft structures, and it is also included in studies to prepare its use in many industries for high thermal conductivity and good types of crystal latest on a large scale in the future. Some materials may acquire unique and specific properties when processed at the nano level, and they may be mechanical properties, electrical properties, magnetic properties, and other miscellaneous properties. Therefore, The phenomenon of the tendency of nano-materials to clump together and there is another difficulty which is the communication between the concept of the modern nano [6-8]. Coppola et al stayed the ability to manufacture dense or sophisticated ceramic pieces starting with photosensitive ceramic slurry has piqued interest in Digital Light Processing (DLP). Despite their wide range of applications, Al_2O_3 and ZrO_2 are investigated nano-ceramic resources for DLP, with limited investigations on their composites. By combining ready to utilize Al_2O_3 and ZrO_2 .slurries, three alumina and zirconia composites (15%, 50%, and 85% vol. of

ZrO_2) were created. The mechanical properties of nano-composites made using the DLP procedure were tested and related to those of reference materials such as basic zirconia and alumina. Temperatures of the sintering for each composite was tuned based on ending microstructural development and density, with the goal of achieving a target [9]. Rezaee and Ranjbar investigated the thermal conductivity confection of permeable Al_2O_3 20 wt. % and ZrO_2 (3 mol. percent Y_2O_3) composites niobium was tested as a function of temperature and porosity. The ceramic powders were made utilizing alkoxide precursors and the sol-gel method. Using starch as a space holding material, the composites porosity was kept between 9.5 and 65 percent. After completing the treatment process, samples were uniaxial crushed and sintered for 3 hours at about 1600º centigrade. For porous ceramic compounds, the thermal conductivity is with and without impurities was determined using the laser-flash technique at three distinct temperatures of 300, 473, and 673 K. The thermal conductivity coefficient of the samples decreased as the porosity and temperature increased [10]. Postek, and Sadowski investigated the multiple phases of Ceramic composites (CCs), they're used in almost every key industry. CCs are frequently subjected to varying dynamic loads, collisions, and high temperatures. The influence of thin sheets made of Al_2O_3-ZrO_2 is investigated in this research. The plates are made of the CC mentioned above in various quantities. Per dynamics, like quasi-static tension, is used to study damage progression. The goal of this research is to characterize how impact damage develops in CC sheets and what function phase contents play. Phase ratios in the tested CC were discovered to be critical for plate behavior [11]. Duntu et al. investigated hybrid composite alumina, which comprises more than one nanoparticle within an aluminum core mineral matrix, shown an advance property in the base matrix material. The researchers note that differences in mechanical properties, such as optimum formulations and quality of additives that produce improved qualities, further investigation may be needed in order to determine the improvement of mechanical properties, synergistic effects and underlying mechanisms of the presence of nano-additives on the aluminum matrix. Structure of the crystal lattice and properties of the compounds Alumina - graphite (0.5wt. %) and Alumina -Zirconia (4wt. % and 10wt. % respectively) were investigated as a baseline for several syntheses in the present work. Despite the fact that adding 10 percent ZrO2 to the alumina matrix reduced particle size , adding 4 percent ZrO2 increased grain size [12]. Sktani et al steadied Zirconia hardened alumina (ZTA) is a creative composite for cutting edge modern applications due to its better mechanical properties analyzed than both Al2O3 and ZrO2. Accordingly, the last audit zeroed in on the advancement of Z.T.A pottery through controlling powder arrangement and the processes of densification. The ongoing audit confirmed the impacts of adding different added substances into Z.T.A ceramics using a few sintering procedures and arrangement courses to additional improve their mechanical properties through administering their microstructure design. It shows that the number, complete amount and porosity of added substances with Z.T.A fixings, size of the grains, and the quantity of optional stages are significant boundaries influencing the mechanical properties. This survey likewise detailed the latest advancement in the improvement of properties of Z.T.A as an option in contrast to other expensive related progressed materials businesses [13]. Sadowski et.al, in this paper presents the results of research on common stabilized Al_2O_3 and ZrO2 nano material, and four ZrO_2 /Al_2O_3 nano composites. The manufactured specimen differ in the ratio of composition (Al_2O_3) content at 20, 40, 60, and 80 wt. %. The test was performed using a nano-indentation tester, a micro-indentation and Vickers hardness tester. Four applied force of 0.002N, 0.2N, 20N and 98.1N were used. Was test used with the Vickers diamond tip. Analysis of the results was performed with indent software and a force-depth indent curve and hardness HVN were obtained. This kind of experimental data is also needed to properly create a numerical model [14]. The purposes of preparing this research paper are to conduct a comparative study of effect of adding two different nano materials to improve the properties of Aluminum core alloys.

2. Materials and method

2.1. Aluminum alloy

Aluminium 6261 is a member of the family of 6000 series Aluminium alloys: multi-functional alloys with both Silicon and Magnesium, the alloy has been formulated for pre-form into worked products and the aforementioned elements are used as the basic alloying elements. 6261 is the Aluminium Association (AA) designation for this substance. , and number EN AW-626 in European Standards. Aluminium alloy 6261 is found in many industries it's a result of its good corrosion resistance, weld ability, mechanical process ability, and medium to high strength. 6261 Aluminium is the same density as pure aluminium about (2.70 g/cm^3), and can be further enhanced using a heat treatment process. Some common types of 6261 aluminium are 6261-T4, 6261-T5 and 6066-T6. This Aluminium alloy has a good combination of strength, corrosion resistance and ease of operation, which makes it an ideal general-purpose alloy. Although they do not excel in any one area, they have been used in marine, pipes, construction materials, food cans and chemical equipment.

Table 1. The chemical composition of (6261AA) all values are weight percentage.

	Magnesium (Mg)	Silicon (Si)	Manganese (Mn)	Copper (Cu)	Chromium (Cr)
Ref.[15]	0.7to1.0	0.4- 0.7	0.2 to 0.35	0.15 to 0.4	0 to 0.1
empirical	0.83	0.58	0.25	0.24	0.0
	Iron (Fe)	Zinc (Zn)	Others	Titanium (Ti)	Aluminum (Al)
Ref.[15]	0 to 0.4	0 to 0.2	0 to 0.15	0 to 0.1	96.6-98.6
empirical	0.37	0.15	0.15	0.1	Balance

Chemical compositions are taken from reference [15] Domains represent what is permitted by applicable standards. While the analysis (experimental) was Standard done at SEHEE [State Establishment of Heavy Engineering Equipment] some properties of 6261 AA (physical and mechanical) will be exposed in table 2.

Table 2. The properties of 6261 AA-alloy (physical and mechanical)

worker	Density (gm/cm^3)	Hardness (HB)	UTS (MPa)	Young models (GPa)
Ref.[16]	2.70	43	150.0	70-80
present	2.71	43	160.0	78
	Yield (MPa)	Metal alloy		
Ref.[16]	95	6261 AA	--	--
present	98	6261 AA	--	--

2.2. Nano material

The fortification materials used in current nano- composite are SiC and ZrO_2 with a diameter about 10 nm for both material, The reason Due to the stress concentration that is easily formed in the SiC/Al surface micro-regions, the bulky SiC may cause serious plastic loss of SiC/Al composites which has limited their applications.is the importance of taking the diameter into consideration for the reinforced nano-materials, as the diameter is a function of the size of the surface area and therefore the bonding and cohesion forces of the materials of these alloys, as well as the fact that the smaller diameter helps the good distribution of nano-materials in the mixture. [17-19The purity utmost (99.0 wt. %) provided by Nano and Occult Materials Corporation (Houston, TX, USA), and it was utilized fortification stage for the coalition of silicon carbide and zirconia nano-composites. Zirconia, consisting of zirconium dioxide ZrO_2, has its own set of specifications such as the absolute highest tensile and compressive strength and room temperature fracture toughness of all nano-ceramic. Recently, zirconia materials are getting attention for dental implants because of their tooth-like color, mechanical properties, good abrasion and biocompatibility. [20] Some properties of the nano-material (SiC and ZrO_2) are listed in Table .3.

Table 3. The properties of SiC and ZrO_2 nanomaterial

Material	Workers	Density gm/cm^3	Grains size (nm)	Hardness	Toughness (MPa. M$^{0.5}$)	compression strength (MPa)
silicon carbide	Ref.[7]	97.3-99.2	20-30	--	6.2	870
silicon carbide	Experimental	96.2	10	25 HB	--	830
zirconia	Ref.[21]	5.68	20-30	1220 VH	10	1200
zirconia	Experimental	5,58	10		--	1290

2.3. Preparation of the composites

The stir casting method has been relied upon due to its multiple benefits for preparing 6261Al / SiC and 6261Al / ZrO_2 composites. The aluminum is shredded and smelted, the hardened SiC and ZrO_2 particles are pre-heated to 473° kelvin before being placed in the molten metal. Speed of the stirrer was (450) rpm and temperature of the casting was 1123° kelvin. More details about prepare rig of the composite with nona-material (for more information on this process visit Ref. [2].

2.4. The rule of mixture

Mixture rule using 6261 AA alloy as a base metal matrix, showing the weight percentages and weight percentages of the additives and the base material in grams, this mixing ratio was measured after the procedures of the smelting process. Table 4 shows the mixture rule

Table 4. Rule of the mixture used in this work

No.	Composite	AA (gm)	SiC (wt.%)	SiC (gm)	ZrO_2 (wt. %)	ZrO_2(gm)
1.	AA	500	--	--	--	--
2.	AA/0.5%SiC	497.5	0.5	2.5	--	--
3.	AA/1%SiC	450	1	5	--	--
4.	AA/1.5%SiC	492.5	1.5	7.5	--	--
5.	AA/2%SiC	490	2	10	--	--
6.	AA/2.5%SiC	487.5	2.5	12.5	--	--
7.	AA/0.5% ZrO_2	497.5	--	--	0.5	2.5
8.	AA/1% ZrO_2	495	--	--	1	5
9.	AA/1.5%ZrO_2	492.5	--	--	1.5	7.5
10.	AA/2%ZrO_2	490	--	--	2	10
11.	AA/2.5%ZrO2	487.5	--	--	2.5	12.5
12.	AA/0.25%SiC+0.25% ZrO_2	497.5	0.25	1.25	0.25	1.25
13.	AA/0.5%SiC+0.5% ZrO_2	495	0.5	2.5	0.5	2.5
14.	AA/0.75%SiC+0.75% ZrO_2	492.5	0.75	3.75	0.75	3.75
15.	AA/1.0%SiC+1.0% ZrO_2	490	1	5	1	5
16.	AA/1.25%SiC+1.25% ZrO_2	487.5	1.25	6.25	1.25	6.25

2.5. Specimen geometry

The specimens of tensile test was finished as stated by ASTM E8/E8M-09,[22]The composite materials for samples with a diameter (55 mm) and a length (150 mm) were obtained from metal casting molds. Then the samples were prepared using a high-precision CNC lathe. The geometry of the tensile test samples is shown in Figure 1.

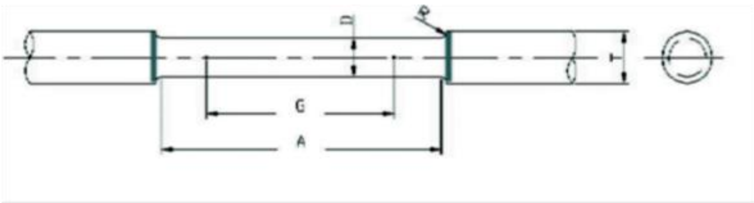

Figure 1. Specimen used for tensile testing

Table 5. Specimen tensile test dimensions

No.	Dimension	Basic(mm)	Tolerance(mm)
1	G. Gauge length	30.0	0.06
2	D. Diameter	06.00	0.10
3	R. Radius of fillet	6	0.05
4	A. Span length	36	0.12

3. Results and discussion

3.1. Hardness

Type of test :(Brinell-hardness test), was utilized in determining hardness values of the test Specimens according to the ASTM E10-18 standard [23], Strength in the test: 306.45 Newton, Total time of application of force: (12) seconds. , The diameter of Ball: (2.5) mm, test conditions; temperatures☹ 300°-340[0)] Kalvin, Relative humidity: 24- 29%. The test was conducted according to the standards ASTM E10 [18]. specimen Name: Al 6066, composite(first band) Al 6261 / SiC – 0.5%, 1.0%, 1.5%, 2.0% and 2.5%wt. composite (second band)Al 6261 /ZrO_2 – 0.5%, 1.0%, 1.5%, 2.0% and 2.5%wt .composite Al 6261 / SiC+ZrO_2 with different ratios .The test results listed in Table 5.

Table 5. Hardness various wt. % for SiC and ZrO_2 nano particles

No	material	(HB)	Improve %	*No.*	material	(HB)	Improve %
1.	6261Al	43.1	--	*9.*	Al/1.5%ZrO_2	51.3	19.0
2.	Al/0.5%SiC	45.7	6.0	*10.*	Al/2%ZrO_2	55.3	28.3
3.	Al/1%SiC	49.3	14.3	*11.*	Al/2.5%ZrO2	51.8	20.1
4.	Al/1.5%SiC	52.3	21.1	*12.*	Al/0.25%SiC+0.25%ZrO_2	47.3	9.2
5.	Al/2%SiC	56.6	30.6	*13.*	Al/0.5%SiC+0.5% ZrO_2	51.8	20.1
6.	Al/2.5%SiC	53.0	22.9	*14.*	Al/0.75%SiC+0.75%ZrO_2	54.2	25.7
7.	Al/0.5% ZrO_2	44.7	8.61	*15.*	Al/1.0%SiC+1.0% ZrO_2	58.6	35.9
8.	Al/1% ZrO_2	48.1	11.6	*16.*	Al/1.25%SiC+1.25%ZrO_2	54.7	26.9

The Brinell hardness test was chosen in this work and the arithmetic mean of the average of three readings was taken. The results of the practical tests (taken in the middle of the samples) were shown in Table 5, while these results were drawn in Figure 2. The laboratory results showed that there is a very clear increase in The hardness values after adding nano materials to the base alloy, and this improvement may be due to the increase in the strength of the bonds between the crystal lattice due to the interference of the nanomaterial in the overlapping regions in the crystal lattice, as well as it may be due to the hardness of the nano materials itself [24].

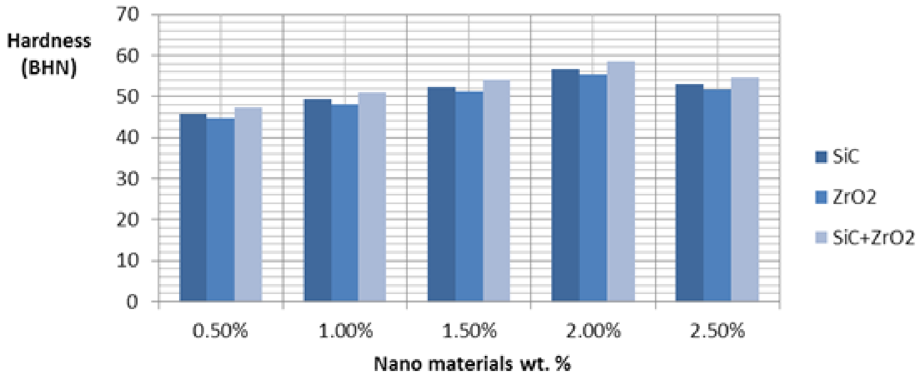

Figure 2. Hardness number vs. weight % of nano additives

It is clear, from Figure 2, that there is an increase in the hardness after the gradual addition of the nano material weight ratio, the addition of nano material resulted reductions in the grain size of the Aluminium composite, increase in hardness as a result of the distribution of nono reinforcement along the grain boundaries of the parent Aluminium matrix, which restricts grain coalescence and growth during casting [25]. The highest hardness increase of 30.6% occurred for AA6261/ SiC at and 28.3% for AA6261 /ZrO_2 and 35.9 % for AA6261 /1.0%SiC+1.0% ZrO_2 .In contrast to as reserved, it is perceived from Figure2, the upper hardness value is found at 2.0 wt% ratio of SiC ,ZrO_2 and SiC+ZrO_2, all the amount of Al/ Nano material is higher than that of the reserved one. The main reasons for the improvement can be the following: It is possible that the high hardness number of the two types of reinforcing particles used in this work is the main reason for the increase in Aluminium hardness of the compound. The identical distribution of the reinforcing materials and low porosity may cause a high value of the hardness (The weight 2.0%) is greater than the hardness number for each of the two materials on its own, due to the presence of a greater ability to move the outer electron in the outer orbitals of the reinforced materials.

3.2 Tensile test results

Conditions of the Test; Temperature of the Test was (28 °C), Moisture: (45%) and the standard ;(ASTM E10/18).The experimentally obtained tensile test results are arranged in Table.6,

Table 6. The experimentally obtain tensile test result

No.	Material	D(mm)	A(mm^2)	UTS(MPa)	YS(MPa)	Elongation (%)
1.	AA	6.08	29.03	160	151	17
2.	AA/0.5%SiC	6.03	28,56	256	197	13
3.	AA/1%SiC	6.06	28.84	312	167	11
4.	AA/1.5%SiC	6.08	29.03	364	211	10
5.	AA/2%SiC	6.02	28.46	383	341	8
6.	AA/2.5%SiC	6.08	29.03	328	177	9
7.	AA/0.5% ZrO_2	6.03	28,56	233	137	15
8.	AA/1% ZrO_2	6.06	28.84	283	175	13
9.	AA/1.5%ZrO_2	6.02	28.46	321	124	8
10.	AA/2%ZrO_2	6.03	28,56	304	189	9
11.	AA/2.5%ZrO2	6.06	28.84	248	167	11
12.	AA/0.25%SiC+0.25% ZrO_2	6.08	29.03	264	199	13
13.	AA/0.5%SiC+0.5% ZrO_2	6.02	28.46	338	239	10
14.	AA/0.75%SiC+0.75% ZrO_2	6.03	28,56	389	201	6
15.	AA/1.0%SiC+1.0% ZrO_2	6.06	28.84	341	231	8
16.	AA/1.25%SiC+1.26% ZrO_2	6.08	29.03	286	177	12

The result of results of Tensile Strength vs. wt. % nano materials Ultimate Tensile Stress test against wt. % nanoparticles (SiC and ZrO_2) is drawing as in figure (3).

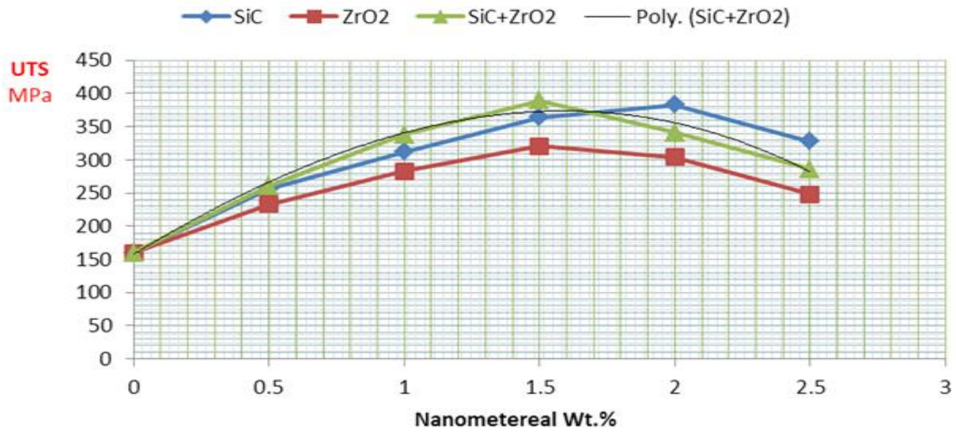

Figure 3. Tensile Strength results vs. wt. % nano materials

Aluminium lattice composites are really utilize for high delivering authorization like military, aviation, and auto business. In solicitation to get amazing mechanical and physical properties the kick the bucket and pressure strain in the projecting system, is required. Figure.4 shows up the change in (absolute tensile strength) with each of the two weights reinforcement materials. %. It is observed that an increase in weight% of nano material leads to an increase in ultimate tensile strength. However, the increased Max values Event at 1.5 wt. % ZrO_2 and $SiC+ZrO_2$ for 6066 AA 58.49% and 92.07% respectively compared to as resave. Karthikeyan et.al [26] they tested the tensile strength of the five LM6 samples with 0%, 3%, 6%, 9%, and 12%, of ZrO_2 respectively, and it was evident in their results that the final ultimate tensile stress was obtained for specimen No. 5, which contains about 12.0 % of ZrO_2 nano material. Therefore, this shows the ultimate tensile stress increases with the increase of nano ZrO_2 added. Li, et.al [27] The high-tensile strength Al-Si (A390) matrix reinforced with TiB_2 particles was tensile tested and prepared by dissolution reaction method,. The researchers considered that the TiB_2 particles tended to adsorb into the Si of the base alloy, due to its high surface energy and strong adsorption capacity, he was found that there is a matching good lattice coherence, which belongs to the corresponding levels and directions, and with the addition of TiB_2 particles, it is evident that it improves the mechanical properties including the ultimate tensile strength. The improvement in ultimate Tensile Stress (IMP) = [(σn –σc)/σc] %, where; IMP.= improvements in tensile strength , σn is Tensile strength of denoting a composite material that has a grain size measured in nanometers., σc is Tensile strength of as received materials. [19] Thefor The improvement in ultimate Tensile Stress (IMP) listed in table 7.

Table 7. Improvement in ultimate Tensile Stress

No.	Material	UTS(MPa)	IMP(%)	No.	Material	UTS (MPa)	IMP (%)
1.	AA	160	0.0	9.	AA/1.5%ZrO_2	321	58.4
2.	AA/0.5%SiC	256	23.2	10.	AA/2%ZrO_2	304	50.1
3.	AA/1%SiC	312	50.1	11.	AA/2.5%ZrO2	248	22.4
4.	AA/1.5%SiC	364	75.1	12.	AA/0.25%SiC+0.25% ZrO_2	264	30.3
5.	AA/2%SiC	383	84.3	13.	AA/0.5%SiC+0.5% ZrO_2	338	66.8
6.	AA/2.5%SiC	328	57.8	14.	AA/0.75%SiC+0.75% ZrO_2	389	92.0
7.	AA/0.5% ZrO_2	233	15.0	15.	AA/1.0%SiC+1.0% ZrO_2	341	68.3
8.	AA/1% ZrO_2	283	39.7	16.	AA/1.25%SiC+1.26% ZrO_2	286	41.2

The change in the basic properties may be due to the phase shift in the crystal lattice represented by an increase in the dislocation density, which leads to an enhancement of the mechanical properties. The high disintegration density comes from the good consistency and uniformity of distribution between the reinforcing material and the base material. Minimum porosity during fabrication, from the above it is clear that the performance of the nano composite leads to raising the final tensile stress and yield stress properties with almost no increase in weight density, and this is one of the most important points leading to improving the strength-to-mass ratio required in the transportation and aerospace industries. Figure (4) shows improvement in highest Tensile Strength vs. (SiC, ZrO2 and SiC+ZrO2) wt. % nano particles.

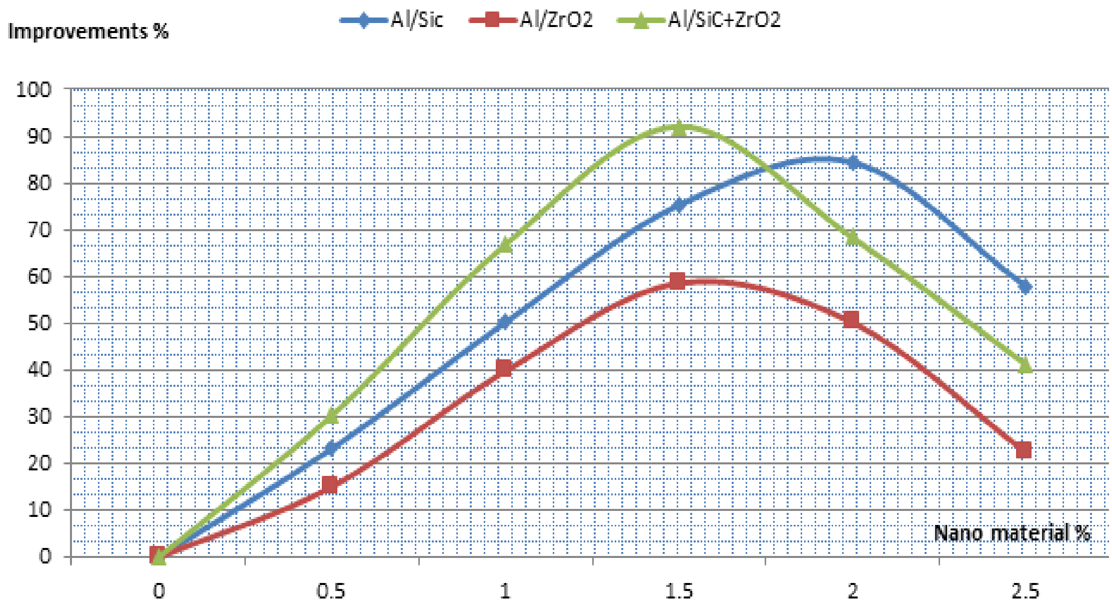

Figure 4. Improvement in highest Tensile Strength vs. (SiC, ZrO_2 and SiC+ZrO_2) wt. % nanoparticles

Boppana et. al, [1] they was shown that the treated hybrids had a change in many mechanical properties, it was observed that with the addition of ZrO2 and graphene particles, the strength of the hybrid compounds improved and the uniform deployment of the reinforcement support in the aluminum alloy was confirmed. The tensile strength was increased with the increase in weight of the nano-strength when contrasted with the cast-array. The increase in tensile strength is attributed to the solid ZrO2 particles which share the strength with the matrix and result in better resistance against the applied tensile load. From table.7 and figure.4 show that at 1.5 %w.t nano-composites has been get best results for ultimate stress, we conclude that the improvement of the tensile property has been achieved at a proportion, so we will rely on the most severe at this point to achieve an accurate study of the improvement of this property relative to the base point (160 MPa) in the case of changing the speed of plumbing, the improvements in ultimate stress of 2.0% of Sic and of 1.5% for both. (ZrO_2 and SiC+ZrO_2) na no-composites.

3.3. Ductility

It appears from Table [6] and Figure [5] that the ductility varies with a change in weight ratios of nano material. It is evident the ductility of 6066AA /ZrO_2 and 6066 AA /SiC+ZrO_2 decreases with the increase of the reinforcing particles in three experimental work stages, which causes an obvious change compared to the Aluminum alloy without nano particles. From laboratory experiments, practical results were obtained that, there appears to be trend in the ductility towards successively decreasing until at 1.5wt. % which was the largest decrease in ductility for both of the above-mentioned composite materials. The largest decrease was achieved at 2wt. %for 6066AA/SiC from this observation that the percentage difference for the largest drop in ductility We tend to the fact that Zirconia plays the dominant role in the ductility properties more than silicon carbide. The discrepancy in the ductility results in the case of two different nano materials may be due to Electron configuration: $4d^2 5s^2$ for zirconium While it is Electron configuration: $3s^2$ $3p^2$ for silicon, Which may lead to an increase in the bonding forces between the nano-material reinforced with aluminum as a substrate to the composite material, This causes the difficulty of creating new sliding levels in the crystal lattice of the nano materials-reinforced alloy, thus increasing the obstacles to completing the sliding process itself and reducing the ductility.

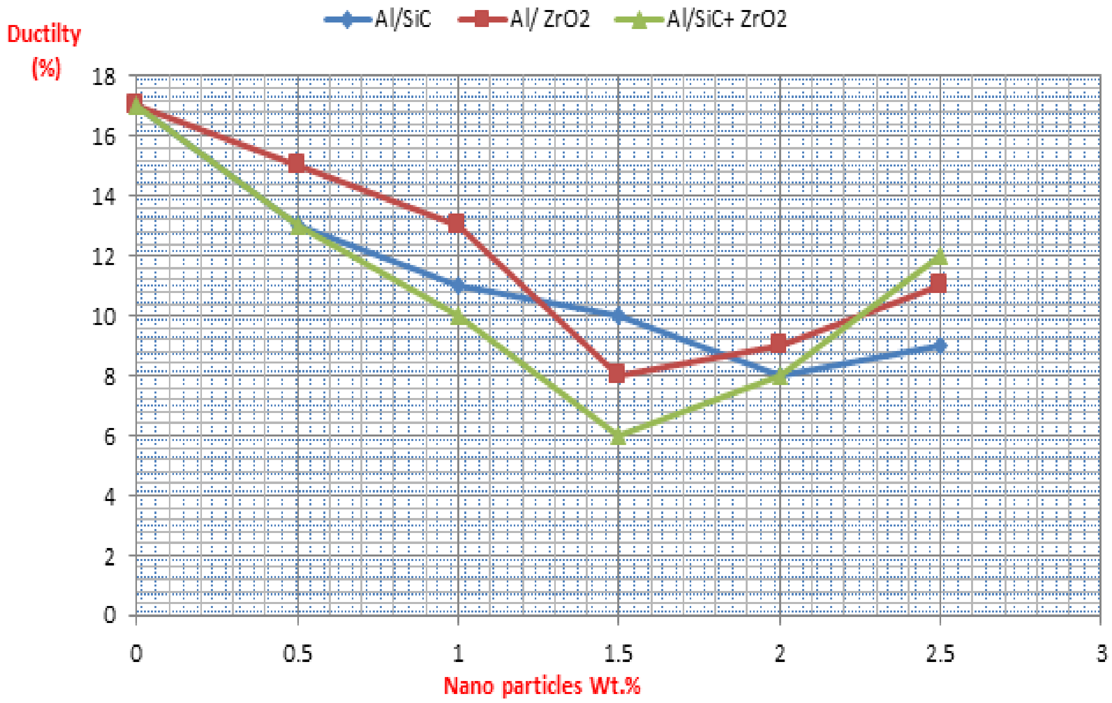

Figure 5. Experimental ductility vs. wt. % of nano material

4. Conclusions

The6261 AA grounded composite was fabricated by the stir casting process with an equal distribution of SiC and ZrO_2 particles. The main observations gleaned from this work are an attempt to understand the interaction between two nano materials with an aluminum metal matrix, that leads to a change in some majors properties, namely;

1. The greatest improvements in UTS was occurred at 1.5% wt. of ZrO_2 and (%SiC+% ZrO_2).The improvements were (75.1 %) and (92 %) respectively. While UTS improvements (84.3%) for Al/ 2.0wt. %SiC.
2. The consequence display that hardness increase of 30.6% for AA6261/ SiC and 28.3% for AA6261 /ZrO_2 and 35.9 % for AA6261 /1.0%SiC+1.0% ZrO_2, occurred addition 2.0 wt. % of nano material to 6261 AA metal alloys.
3. The better amelioration of ductility was found at 1.5 wt. % of Al/ZrO_2 and Al/SiC +ZrO_2.The was reduced of ductility from 17% as resaved to 8% and 6wt. % respectively .while ductility decrease from 17% to 10% for Al/SiC at 1.5 wt. % of SiC.
4. The tendency of some mechanical properties to noticeable improvement may be due to an increase in the cohesive strength between the components of the alloy and the nanomaterial, and the presence of nano materials may be stuck in the formation of slip levels, or an increase in the porosity of the base alloy and an increase in the dislocation density.

Acknowledgements

The author thanks to University of Al-Mustansiriya , Department of Mechanical Engineering for Provide many facilities for the completion of this work.

Declaration of competing interest

The authors declare that they have no any known financial or non-financial competing interests in any material discussed in this paper.

Funding information

No funding was received from any financial organization to conduct this research.

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