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A Study on Alumina Nana Particles Mechanical Properties using the GRA Method

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Abstract: *Alumina is nanoparticles one of which is chemically incompatible organics matrices such as poly (methyl methacrylate). In this study, nanoparticle interactions were enhanced by In situ polymerization of methyl methacrylate alumina nanoparticles, and these modified nanoparticles are used as useful additives in palm manufactured using injection molding process. Effect of modification process on dispersion quality of nanoparticles in was investigated by microscopy experiments. The results indicated that compared to unmodified alumina nanoparticles modified process, the alumina nanoparticles are excellent dispersion and connectivity. The Taguchi approach was implemented to optimize and Input parameters tests. MCDM methods were also process parameters. Impact and tensile strength of samples with 2 wt% modified alumina nanoparticles, therefore A-05 has higher values and A-03 has lower values respectively the A sample containing The same unmodified alumina nanoparticle content.*

Keywords: *GRA, Mechanical Properties, Bio Mechanical Properties.*

1. INTRODUCTION

Alumina is nanoparticles one of the important metals oxidizes with good physic mechanical properties, but they have the problem of chemical incompatibility the polymer matrices. Various composition and in situ polymerization have been invented developed to overcome this problem. Mallakpur and Gamete studied aggregation Alumina nanoparticles into an organic matrix used provides, leading a variety of compounds with promising properties. In Tar Alumna's work, the nanoparticles were synthesized using a modified method. Polymeric nanocomposite applications are currently spreading across various aspects of science and industry Apart from light weight. Nevertheless, these properties can only be obtained in high quality materials products optimal manufacturing process. One of the main problems of nanocomposites is perfect compatibility the non-material underlying polymeric matrix, which greatly affects the final properties. Various A varieties of studies have been conducted in composites by trying to maximize applicability non-material. As maximize achieve Maximum output results. Multiple Criteria Decision Making (MCTM) methods are powerful tools for selecting test improve output characteristics. In these methods, Criteria are analyzed to choose alternative from all available options. A variety of MCDM methods are applied to engineering problems including material selection and process optimization. MCDM methods were used select one of were designed with Taguchi orthogonal array. Approaching MCDM, optimization hydro forming the process was conducted GRA methods. Abrasives were investigated using water jet cutting multi-response optimization GRA method, and the results point to it the multiple response characteristics the cutting process could optimized Using this MCDM method. A Multiple criteria result Analyzed Microcellular polymeric nanocomposites Injection Molding Choose the best models. Mechanical and morphological properties are Viewpoints. The best nanoparticles were selected using the MCDM method to improve Mechanical properties dental applications, so A-05 had high values and A-03 had low values.

2. MECHANICAL PROPERTIES

Effect Na content the Impact strength the Models for modified and unmodified nanoparticles are illustrated with the addition of unmodified alumina nanoparticles; Impact strength increases A little, whereas impact strength increases with Addition of modified alumina nanoparticles. Incorporation of nanoparticles into Polymeric matrix improves strength effect nano composites Because of The crack-deflection effect of these materials. In other words, nanoparticles inhibit brittle crack growth the so the team, more material and impact strength are absorbed

by adding Nanoparticles. This increase was significant Due to their chemical, unmodified alumina nanoparticles is used. In contrast, there is modified alumina nanoparticles suitable conformability and are highly impacts sensitive.

3. BIO MECHANICAL PROPERTIES

A property often used to classify machinery behavior Compressive strength of bone grafts. As these materials are used as a bone substitute, which Important remember called compressive strength (along with the tensile strength) Cortical bone of man is in between, whereas compressive strength primary there is bone between. Calcium phosphate usually provides less biomechanical support because they are fragile and TCPs with small is the tensile strength relatively however, less fragile, rapid Decomposition of TCP results rapid. Decreased porosity and pore size caused by basalt formation, resulting decreased mechanical properties, as it Compromises the structural integrity of scaffolds. Furthermore, Scaffolds highly deformable rates should not be highly porous, as rapid wear of the material prior to replacement by newly formed bone compromises mechanical and structural integrity. However, there are upper limit porosity and pore size constraints. Related to Mechanical properties increase with vacuum decreases Mechanical strength scaffolds, important Lead-out-bearing bonus in battle regeneration. Battle Example, Incisors in total pore size leads to Four times reduction in mechanical strength. In its manufacture, to what extent the Aperture Can increase in size while maintaining machining requirements depends among many factors including the nature of the material used and processing conditions. Hydro gels Mechanically strong triple-network hydro gels containing poly (acrylic acid) with conductive the hydro gel acts as a third network. The prepared hydro gels show a high stress breakdown pressure and still retain the electrical activity of the conductive components. The successes of hydro gels in reinforcing Materials are attributed to the complex microstructure and variable molecular organization of three networks conductive polymer Based on Experimental results and DN and/or TN theories, proposed. Additionally, Applicability of TN hydro gels electro sensors and super capacitors are briefly discussed. Current the findings have proven successful activity development mechanically strong hydro gels, DN and TN hydro gels, are of major importance in education and practice. Hydro gels they Because of the chemical bonds or physical nodes and A three-dimensional hydrophilic polymer network at, which amounts water, hydro gels Based on conducting polymers attracted much attention last. The properties hydro includes Conduct specific traffic characteristics polymers, which originate from their unique p-coned structures. Nowadays, a very an obvious but intractable problem in Conducting polymer hydro gels, Lack of mechanical hardness, can be a hindrance. A very an important application for this type of material their extensive applications are in fields ranging electro sensors capacitors for electromechanical actuators and artificial muscles. An alternative way this problem is solved to blend Typical insulating polymers hydro gels produce materials with Mechanics Later properties. Unfortunately, such a one mixed process is common changes Physical properties of the insulating matrix and the mixture hydro gels mechanistic. Mechanical Performance Integrating Mechanical performance with environmental implications of glass reinforced there is an unprecedented parameter, no user has found a framework that sets target performance and machining A achieve performance specific Amount of specific glass waste composition. One such structure should also include the option to link environmental impacts to engine performance. Conventional and glass waste concrete results high workability and mechanical efficiency, while sustainable concrete is selected with minimal CO2 footprint and minimal use Conventional natural ingredients. For optimization, relative the values of the designed parameters, Analytical Hierarchy Process (AHP) and Optimal Solution (TOPSIS) Translated into glass waste management framework prioritizing through convergence with technology. Similar preference of all kinds compounds by the structure using Multi-criteria decision-making techniques. The adjusts Priority weights for each criterion as needed, and can be used criteria. Optimum amount of for Static concrete production development as are the primary concerns of this proposed work. For this purpose, multiple Decision criteria (MCTM) techniques were used are useful in solving complex problems that cannot be solved directly. The basic for using The MCDM technique is that the solution should be based on simple criteria considering more than one attributes Therefore, Adopting Two MCDM techniques; Analytical Hierarchy Process (AHP) and Sort by Similarity to Best Solutions (GRA). Prioritization technique was applied to experimental observations obtained parameters. The obtained the suggests best mixing ratio with certain characteristics for Manufacturers, researchers, policy makers and stakeholders persons. Help choose; Good workmanship, mechanical performance comparable to minimal Consumption of conventional raw materials.

4. MULTI-CRITERIA DECISION MAKING (MCDM)

Multi-criteria decision making system contains Weight and Ranking levels. In this study, the analysis step Procedure (GRA) method was used in the weighting phase, a general MCDM The approach is carried out and the Ranking of alternatives based on results is prioritized, which is compared with the best solution (TOPSIS) method using the technique sequence. The weights of the GRA method were obtained. The Gray Relational Analysis

(GRA) method was first developed by Deng used to solve various MCTM problems. The performance GRA of all alternatives must first be translated into the relevant order. This step is called gray relative formation. According to these sequences, a large target sequence is penalized. Then, the gray correlation coefficient between the best target sequences for all comparison sequences is calculated. Finally, based on these gray correlation coefficients, the gray correlation degree between each comparison sequence to the best target sequence is calculated. A high level of gray correlation, translated from a constant shift between the best target line and itself, is the alternative best choice. We solve MCDM problems and propose an extended GRA method in which the scale values are in the form of linguistic variables, since the interval values are expressed and the information about the scale weights is unknown. The interval values of the traditional GRA are expressed, based on the basic idea, some optimization models have been established to determine the criteria for a computational extension to the MCDM steps of the GRA method, which is a comparison sequence that is an alternative to translation, shown that the several of data set for Impact strength, Tensile strength, Elastic modulus, Hardness the values are given above the tabulation these data set shown values about A-06.

5. RESULT AND DISSCUSSION

TABLE 1. Data set

	Impact strength	**Tensile strength**	**Elastic modulus**	**Hardness**
A-01	17	45.45	1.69	59.55
A-02	19	43.15	1.73	57.20
A-03	16	41.88	1.78	63.90
A-04	20	37.95	2.19	87.00
A-05	25	50.06	2.29	89.56
A-06	22	38.52	2.37	87.40
A-07	18	47.16	2.14	88.38
A-08	21	43.27	2.36	89.46
A-09	23	48.12	2.22	86.32
A-10	26	33.63	2.44	87.10
A-11	19	43.84	2.34	87.98
A-12	20	36.10	2.29	83.62
A-13	26	45.84	2.28	86.94
A-14	18	30.58	2.20	85.46
A-15	24	39.80	2.28	87.98
A-16	24	39.80	2.28	85.98

Table 1 shown that the several of data set for Impact strength, Tensile strength, Elastic modulus, Hardness the values are given above the tabulation these data set shown values about A-06.

TABLE 2. Normalized Data

Normalized Data			
Impact strengh	**Tensile strengh**	**Elastic modulus**	**Hardness**
0.1000	0.7633	0.0000	0.0726
0.3000	0.6453	0.0533	0.0000
0.0000	0.5801	0.1200	0.2070
0.4000	0.3783	0.6667	0.9209
0.9000	1.0000	0.8000	1.0000
0.6000	0.4076	0.9067	0.9333
0.2000	0.8511	0.6000	0.9635
0.5000	0.6514	0.8933	0.9969
0.7000	0.9004	0.7067	0.8999
1.0000	0.1566	1.0000	0.9240
0.3000	0.6807	0.8667	0.9512
0.4000	0.2834	0.8000	0.8164
1.0000	0.7834	0.7867	0.9190
0.2000	0.0000	0.6800	0.8733
0.8000	0.4733	0.7867	0.9512
0.8000	0.4733	0.7867	0.8894

Table 2 shown that the normalized data for Impact strength, Tensile strength, Elastic modulus, Hardness' these values are calculated using by formulas

TABLE 3. Grey relation coefficient

Grey relation coefficient			
0.9796	0.9946	0.9774	0.979
0.9841	0.9919	0.9786	0.9774
0.9774	0.9904	0.9801	0.982
0.9863	0.9858	0.9924	0.9982
0.9977	1	0.9954	1
0.9908	0.9865	0.9978	0.9985
0.9818	0.9966	0.9908	0.9992
0.9886	0.992	0.9975	0.9999
0.9931	0.9977	0.9933	0.9977
1	0.9809	1	0.9982
0.9841	0.9927	0.9969	0.9989
0.9863	0.9837	0.9954	0.9958
1	0.995	0.9951	0.9981
0.9818	0.9774	0.9927	0.9971

Table 3. A zeta value is constant and the values of 0.9 is given for a grey relation coefficient

TABLE 4. Gra Values

GRA	
A-01	0.9827
A-02	0.9830
A-03	0.9825
A-04	0.9907
A-05	0.9983
A-06	0.9934
A-07	0.9921
A-08	0.9945
A-09	0.9954
A-10	0.9948
A-11	0.9931
A-12	0.9903
A-13	0.9971
A-14	0.9872
A-15	0.9943
A-16	0.9940

Table 4. Obtained by using formulas to calculated the GRG values, the result of the method was shown above.

TABLE 5. Rank

Rank	
A-01	15
A-02	14
A-03	16
A-04	11
A-05	1
A-06	8
A-07	10
A-08	5
A-09	3
A-10	4
A-11	9
A-12	12
A-13	2
A-14	13
A-15	6
A-16	7

Table 5. Shown that the values about the rank. A-05 First rank, A-13 second values so A-05 is high values A-03 is lowest values. Figure 4 shown in ranking.

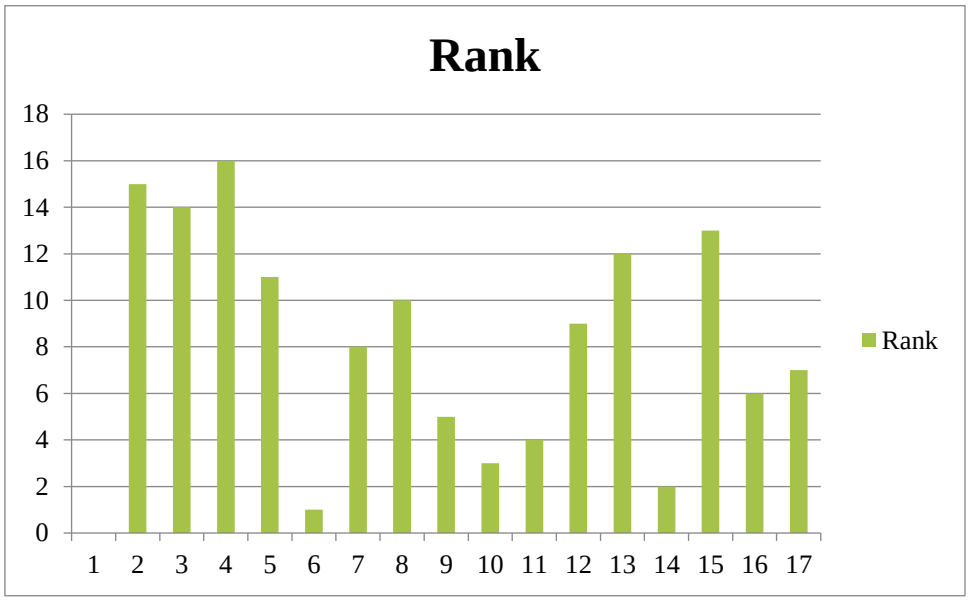

FIGURE 1. Shown that the graph about rank.

6. CONCLUSION

Alumina nanoparticles have good physico-mechanical properties, which is one of the are associated polymeric especially organic polymers. They have a chemical incompatibility problem. This incompatibility leads to poor dispersion of the particles in the matrix and consequently affects their properties. MCDM methods are used a variety of Engineering issues including material selection and process optimization. MCDM methods were used select one of were designed with Taguchi orthogonal array. Approaching MCDM, optimization hydro forming carried out by Kitted Sling GRA methods. Multi-response optimization GRA Abrasive water cutting method studied and the results indicated that the multiple Answer Properties the optimized MCTM method. A Multiple criteria result analyzed on Microcellular polymeric nanocomposites injection molding choose the best models. Mechanical and morphological properties are Viewpoints. The best nanoparticles were selected using MCDM method to improve Mechanical properties dental So A-05 is the highest values and A-03 is the lowest values.

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