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Evaluation Of Dynamic Mechanical Properties Of Composites Using The Weighted Aggregate Product Assessment (WASPAS)

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Abstract: the polyester and polyether urethane block polymers of Dynamic mechanical properties in the temperature range of -150 to 200°C Four frequencies have been studied. Glass transition of ester or ether soft segments temperature (Tg) and aromatic-urethane hard sections along with annealing temp By observing two relevant transition regions The existence of a two-phase structure in these systems was demonstrated. Several secondary relaxations were observed. Cut to 45 mm length Glass and ramie fibres, by Resin Transfer Molding (RTM) hybrid polymer composites used to produce, their bodies, Mechanical and Dynamic mechanical properties relative to glassy-ramie volume fractions and Aims to evaluate overall. With unhesitatingly vague information to solve multi-criteria decision-making problems Based on the Weighted Aggregate Product Assessment (WASPS) approach, an integrated method has been developed. This time the hesitant fuzzy operators, in a typical WASPAS approach some developments and procedures for calculating criterion weights are based on. Criterion and to calculate the decision expert weights, for non-hesitant fuzzy sets, We propose new information measures and Entropy for criterion weights and We integrate the variance measure. Uncertainty Multi-criteria decision-making problems as an inevitable feature, A developed approach to uncertain multi-criteria decision-making situations Will be a useful tool. The alternative parameter is Neat PLA, PLA/Glass (70/30), PLA/RNCF (70/30), PLA/Wood (70/30), Neat PP, PP/Glass (70/30), PP/RNCF (70/30), PP/Wood (70/30). The Evaluation parameter is TG, storage modulus at 25o C, storage modulus at 40o C, storage modulus at 60o C and modulus increase at 25oC. Neat PLA is got the first rank whereas PP/Glass (70/30) is having the lowest rank. Final Result of Dynamic Mechanical Properties using the analysis Method in WASPAS. Neat PLA is got the first rank whereas the PP/Glass (70/30) is having the lowest rank.

***Index Terms* - WASPAS Dynamic Mechanical properties, PLA, MCDM.**

I. INTRODUCTION

The nonlinearity of polyurea Hyper-elastic behaviour by Mooney Rivlin's constitutive factor the strain rate dependence was predicted. Using an INSTRON servo-hydraulic testing machine Model geometry and dynamic mechanical properties of steel sheets affect the boundary conditions examined. At high strain, rates to generate reliable data an improved model design are proposed. Ouellet et al. using a polymeric compression Hopkinson strap investigated in high-rate experiments in two polymeric foams Effect of sample size. The sample size effect was found to be highly significant for EPS, Thus strain-rate effects were masked by the size effect. To investigate this problem more fully, all measurements of elastic modulus and damping factor herein reported were made by a vibrating reed method. Based on WASPAS To evaluate MCDM problems with HFSs methodology and information measures Integrated approach The purpose of the study is to introduce To extend the WASPAS approach with HFSs, HF-aggregation operators are implemented, and A further permutation and weighting product process is implemented. Demonstrate a GSS problem approach, It is also taken to in realistic MCDM problems Explains the performance of the developed method. To explain the results, by varying the criterion weights and the parameter a sensitivity analysis is performed of the developed WASPAS approach. The WASPAS method is popular and efficient for solving a wide range of Problems with decision-making. For WASPAS method the original ideas were first published in 2012. WASPAS is abstract weighted A combination of aggregate and weighted multiplication methods, they are multi-criteria decision-making techniques.

II. Dynamic Mechanical Properties

The time series monthly data is collected on stock prices for sample firmsand relative macroeconomic variables for Hybrid fibers/fillers reinforced Using spun jute and based on compressive modulus. Standardized natural fiber composites and the value of dynamic compression properties of both Affect strain rate. In dynamic mechanical properties Effect of fiber hybridization Researchers recently explored. Over the entire temperature range, Loss modulus was analyzed and increased with fiber content. All loss modulus curves after reaching the maximum decrease at higher temperatures, polymer chains at high temps Expresses free movement. Because within the mix the overall interface area is increased. The effect of fiber content is being studied by researchers. According to the results, by increasing the fiber content an improvement in storage modulus was observed for all reversible viscoelastic deformations over the entire temperature range. Collected at different depths rock samples to clarify mechanical properties, four types of experiments were performed X-ray diffraction (XRD) test, wave velocity measurement, static loading test and Dynamic loading test. Because the length of other rock samples is relatively small, which induces large measurement errors, Wave speed measurements with dimensions were conducted only on rock samples. Collected at different burial depths rock samples were fixed to understand dynamic mechanical properties. Before the tests, At 40°C Six groups of granite specimens after drying for about 24 hours, Crushed and then analyzed finesse were milled uniformly. Selected in each group for XRD testing Rock samples weigh 1 gram. Prepared samples using angular velocity electron microscopy Scanned. Then, test minerals using a powder diffraction fly database were identified. Absorption-corrected for each mineral Using calibration curves Semi-quantitative mineral composition was determined.

III. Materials and Method

WASPS were first proposed In 2012 and going strong New MCDM application is One of the deterministic approaches. This approach is based on the Weighted Product Model (WPM) and of Weighted Sum Model (WSM). Based on the composition. Javadskas, Tarski, Andusevician and Zagarevisius, Waspas proposed and advocated the approach The accuracy of this approach is Stronger than WPM and WSM. Zavadskas, Turskis, Antucheviciene and Zakarevicius, proposed this new method and This integrated method is superior to other approaches Proven to work accurately. Recently, using the WASPAS method Several studies have been conducted and Awarded to The following scholars: Bagocius, Zavadskas and Turskis Select a deep water port WASPAS was used. Stanislas, Medinekinek, Savatskas et al Caliphadas Modernization of several residential houses They used WASPAS for eco-economic assessment: Zavadskas, Antucheviciene, Šaparuuskas and Turskis To evaluate home alternatives used WASPAS; Zavatskas, Anthusevicene, Sabarauskas and Tarski's to check the robustness of methods for evaluating alternative solutions used WASPAS; For structural health monitoring of To evaluate real-time intelligent sensors, Bridges use WASPAS. Dėjus and Antuchevičienė It's a construction site Used to evaluate health and safety solutions and Hashemkhani Solfani, Akdei, Terakhti, Zavatskas and Morshet Varsande to take visionary decisions on business problems Waspas was used. the WASP technique of the algorithm is presented. involves many decision problems and is Used in contexts. Šiožinytė and Antuchevičienė developed Using AHP, COPRAS, TOPSIS and WASPAS methods Daylighting in a renovated local building and To overcome the problem of traditional continuity developed the MCDM approach. To solve the shopping mall detection problem They have many criteria to develop a decision-making approach. Wind farms and Selection of potential sites for evaluation of wind farm types and Waspass method of ranking. Based on SWARA and WASPAS method Structure of bridges Health monitoring. Several criteria form the decision-making approach. Zavadskas, Antucheviciene, Razavi Hagiagha and Hashemi, with ambiguous numbers for the proposed interval-valued intuition Extended WASPAS Method its results with some existing methods. Using the method of Chakraborty and Javadskas WASPAS method. Used to solve multi-scale manufacturing problems. Determining Outsourcing Strategies and the WASP system-based approach. Wayfair, Solfani, Varsande, Teraghti and Eshkalak regions based on priority SWARA and to evaluate solar power projects WASPAS methods were used. Using the WASPAS method A low-energy home energy supply system A multi-criteria evaluation was used. Bozorg-Hadad, Azarnivand, Hosseini-Moghari and Loisika for multi-objective reservoir operation problems. To rank, the Pareto solutions Develop and compare several benchmarking techniques, Introduced WASPAS and COPRAS. For basic health assessment of bridges To evaluate real-time smart sensors introduced the MCDM approach. Some multi-criteria manufacturing problems like the forging stage using WASPAS method were Solved by Chakraborty and Javad Schaus. Zavatskas et al. Interval value intuition introduced WASPAS extended to fuzzy numbers and It combined its result along with some existing Methods of Swara and WASPAS as explained by Wafeepour et al were used to assess the suitability of the area for operation of solar power projects. (2014) WASPAS method to define outsourcing principles developed by Lashkari et al MCDM method.

IV. RESULTS AND DISCUSSION

Table 1 shows the Dynamic Mechanical Properties Analysis using the WASPAS Method. Neat PLA, PLA/Glass (70/30), PLA/RNCF (70/30), PLA/Wood (70/30), Neat PP, PP/Glass (70/30), PP/RNCF (70/30), PP/Wood (70/30) is the Alternative and Evaluation Parameters in TG, Storage Modulus at 25o C, Storage Modulus at 40o C, Storage Modulus at 60o C, and Modulus Increase at 25oC.

TABLE 1. Dynamic mechanical Properties

	TG	**Storage Modulus at 25° C**	**Storage Modulus at 40° C**	**Storage Modulus at 60° C**	**Modulus Increase at 25°**
Neat PLA	63.00000	3.20000	3.10000	1.80000	237.00000
PLA/Glass (70/30)	65.00000	11.90000	11.60000	9.70000	240.00000
PLA/RNCF (70/30)	67.00000	10.10000	9.90000	8.60000	188.00000
PLA/Wood (70/30)	77.00000	10.20000	10.00000	9.20000	218.00000
Neat PP	13.00000	2.90000	2.40000	1.40000	163.00000
PP/Glass (70/30)	18.00000	7.90000	7.40000	6.10000	172.00000
PP/RNCF (70/30)	4.00000	6.50000	5.50000	3.80000	124.00000
PP/Wood (70/30)	15.00000	7.30000	5.70000	4.00000	151.00000

TABLE 2. Performance Value

	Performance value				
Neat PLA	0.81818	0.26891	0.77419	0.77778	0.52321
PLA/Glass (70/30)	0.84416	1.00000	0.20690	0.14433	0.51667
PLA/RNCF (70/30)	0.87013	0.84874	0.24242	0.16279	0.65957
PLA/Wood (70/30)	1.00000	0.85714	0.24000	0.15217	0.56881
Neat PP	0.16883	0.24370	1.00000	1.00000	0.76074
PP/Glass (70/30)	0.23377	0.66387	0.32432	0.22951	0.72093
PP/RNCF (70/30)	0.05195	0.54622	0.43636	0.36842	1.00000
PP/Wood (70/30)	0.19481	0.61345	0.42105	0.35000	0.82119

Table 2 shows the performance value of the Dynamic Mechanical Properties using the WASPAS method it is calculated by the value in the dataset divided by the maximum of the given value of the data set.

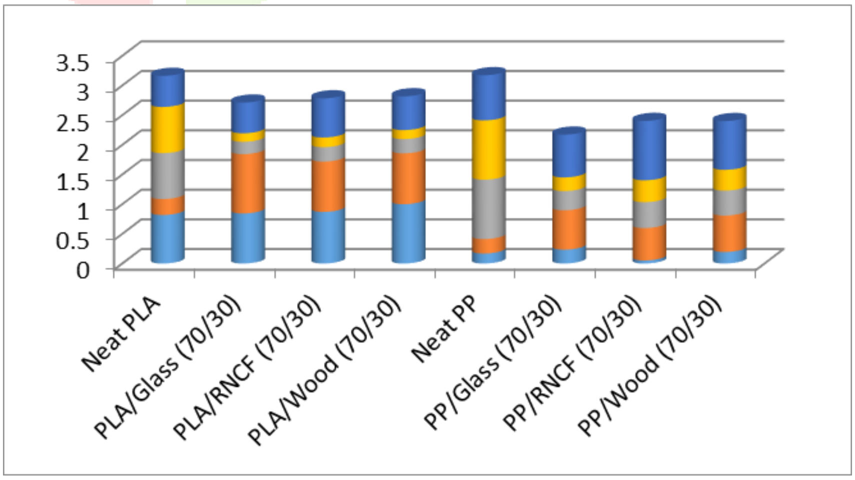

FIGURE 1. Performance Value

Figure 1. Shows the performance Value Dynamic Mechanical Properties in Neat PLA, PLA/Glass (70/30), PLA/RNCF (70/30), PLA/Wood (70/30), Neat PP, PP/Glass (70/30), PP/RNCF (70/30), PP/Wood (70/30) is the Alternative and Evaluation Parameters in TG, Storage Modulus at 25o C, Storage Modulus at 40o C, Storage Modulus at 60o C, and Modulus Increase at 25oC.

TABLE 3. Weight

	Weight				
Neat PLA	0.25	0.25	0.25	0.25	0.25
PLA/Glass (70/30)	0.25	0.25	0.25	0.25	0.25
PLA/RNCF (70/30)	0.25	0.25	0.25	0.25	0.25
PLA/Wood (70/30)	0.25	0.25	0.25	0.25	0.25
Neat PP	0.25	0.25	0.25	0.25	0.25
PP/Glass (70/30)	0.25	0.25	0.25	0.25	0.25
PP/RNCF (70/30)	0.25	0.25	0.25	0.25	0.25
PP/Wood (70/30)	0.25	0.25	0.25	0.25	0.25

Table 3 shows Weight ages used for the analysis. We taken same weights for all the parameters for the analysis

TABLE 4. Weighted normalized decision matrix

	Weighted normalized decision matrix				
Neat PLA		0.06723	0.19355	0.19444	0.13080
PLA/Glass (70/30)	0.21104	0.25000	0.05172	0.03608	0.12917
PLA/RNCF (70/30)	0.21753	0.21218	0.06061	0.04070	0.16489
PLA/Wood (70/30)	0.25000	0.21429	0.06000	0.03804	0.14220
Neat PP	0.04221	0.06092	0.25000	0.25000	0.19018
PP/Glass (70/30)	0.05844	0.16597	0.08108	0.05738	0.18023
PP/RNCF (70/30)	0.01299	0.13655	0.10909	0.09211	0.25000
PP/Wood (70/30)	0.04870	0.15336	0.10526	0.08750	0.20530

Table 4 shows the weighted normalization decision matrix it is calculated by multiplying the weight and performance value in table 2 and table 3 Neat PLA, PLA/Glass (70/30), PLA/RNCF (70/30), PLA/Wood (70/30), Neat PP, PP/Glass (70/30), PP/RNCF (70/30), PP/Wood (70/30) is the Alternative and Evaluation Parameters in TG, Storage Modulus at 25o C, Storage Modulus at 40o C, Storage Modulus at 60o C, and Modulus Increase at 25oC.

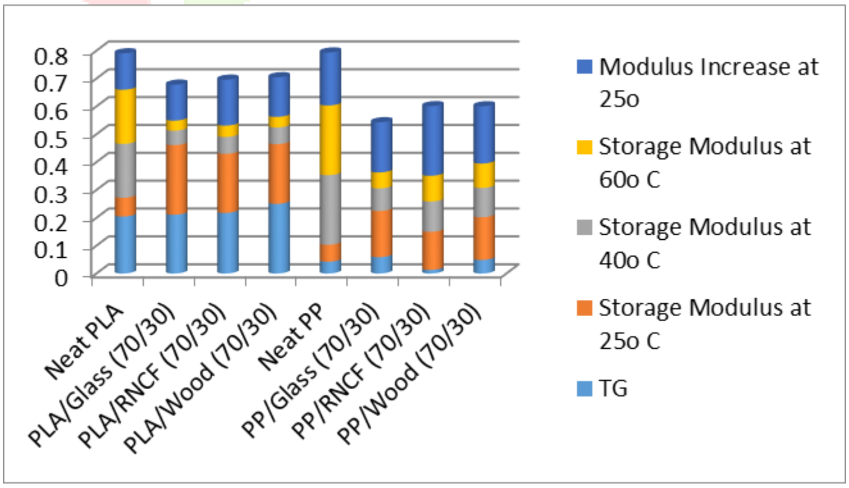

FIGURE 2. Weighted normalized decision matrix

Figure 2 shows the weighted normalization decision matrix it is calculated by multiplying the weight and performance value in table 2 and table 3 Neat PLA, PLA/Glass (70/30), PLA/RNCF (70/30), PLA/Wood (70/30), Neat PP, PP/Glass (70/30), PP/RNCF (70/30), PP/Wood (70/30) is the Alternative and Evaluation Parameters in TG, Storage Modulus at 25o C, Storage Modulus at 40o C, Storage Modulus at 60o C, and Modulus Increase at 25oC.

TABLE 5. Preference Score, WASPAS coefficient, Rank

	Preference Score	WASPAS Coefficient	RANK
Neat PLA	0.79057	0.65184	1
PLA/Glass (70/30)	0.67801	0.50792	5
PLA/RNCF (70/30)	0.69591	0.53413	4
PLA/Wood (70/30)	0.70453	0.53491	3
Neat PP	0.79332	0.60697	2
PP/Glass (70/30)	0.54310	0.42259	8
PP/RNCF (70/30)	0.60074	0.43031	7
PP/Wood (70/30)	0.60012	0.47345	6

Table 5 shows the preference score, the WASPAS coefficient, and the rank of the WSM weighted sum model, which is calculated by the sum of the value in the row of the weighted normalized decision matrix. The priority score of the WPM weighted product model is calculated by multiplying the value in the row of the weighted normalized decision matrix.

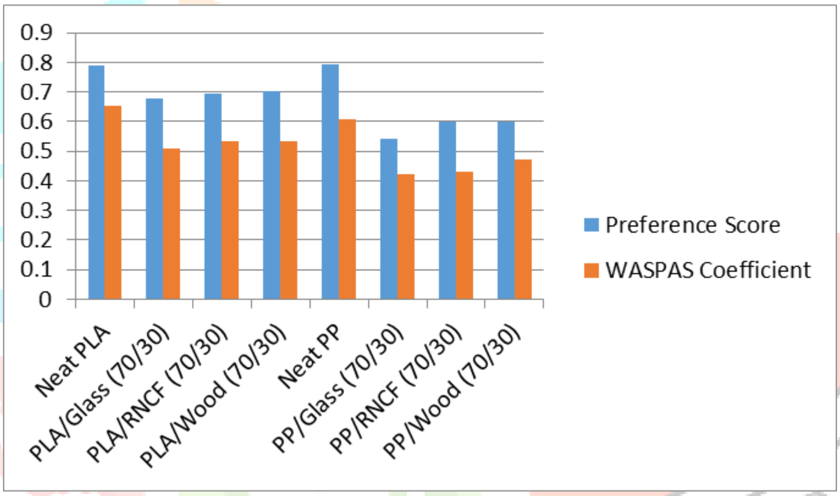

FIGURE 3. Preference Score, WASPAS coefficient

Figure 3 shows the preference score and WASPAS Coefficient of WSM Weighted Sum Model it is calculated by the sum of the value on the row of weighted normalized decision matrix. The preference score of WPM Weighted Product Model it is calculated by the product of the value on the row on weighted normalized decision matrix.

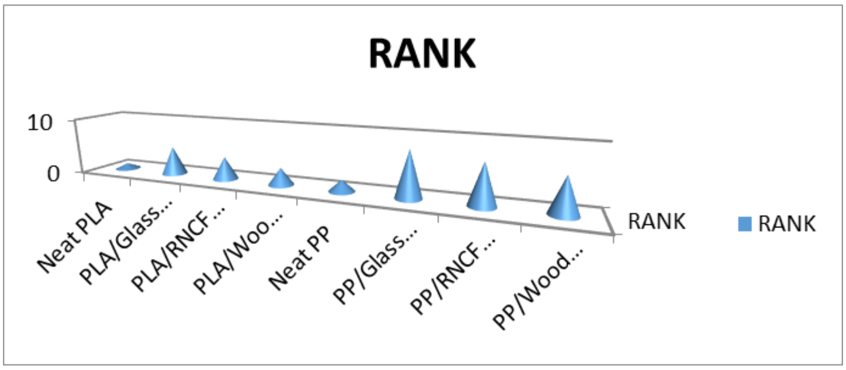

FIGURE 4. Rank

Figure 4 Shows the Final Result of Dynamic Mechanical Properties using the analysis Method in WASPAS. Neat PLA is got the first rank whereas is the PP/Glass (70/30) is having the lowest rank.

V. Conclusion

With reduced weight, this increased stiffness in aircraft fuselages led to its use as a commodity. Face and main objects since large variation is possible, when expected to measure mechanical properties is essential for comparison. To measure dynamic mechanical properties a widely used method is vibration testing, it is commercially available and Adopted for Many dynamic material test systems. In vibration tests, to estimate moisture content in a system method to minimize effects from experimental uncertainty uses a quality factor. Feeding rate and frequency affect the dynamic properties of polymers' two parameters, usually for a decade Loss at a rate increases by a few degrees at peak temperatures. However, in this paper, on temperature and thermal history, we focus on general effects. So we used specific ratio parameters, these are generally used for polymer characterization. Dynamics of biopolymers in specific silks Future experiments are of mechanical properties Rate dependence should be investigated. Latest two new MCDM utility As deterministic approaches ambiguous development of WASPAS and SWARA, Theory and applications Detailed overview This research paper presents Recent, papers related to WASPAS and SWARA assess criteria of WASPAS and SWARA approaches on several MCDM problems, Alternatives have proliferated to rank and perform comparative analysis. Therefore, future studies should use these techniques Can be reviewed and categorized by Ambiguous extensions and gray numbers. Additionally; this study with the WASPAS method Highlights Fuzzy set theory and A significant share of gray numbers. Space-valued intuition Based on fuzzy numbers, Integrated WASPAS System, having a single-valued Neutrosophic synthesis WASPAS method and Gray numbered WASPAS method. Neat PLA is got the first rank whereas is the PP/Glass (70/30) is having the lowest rank.

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