Reinforcement of HDPE by using Nanopartical of Sio2

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Abstract

This work evaluates reinforcement of High density polyethylene using silica nanopartical and scientist as an alternative reinforcement for High density polyethylene composite. Due to their low cost, fairly good mechanical properties, high aspect strength .Lot of silica wasted in India .These silica an environmental friendly. In order to find commercial application the wasted silica mixed with high density polyethylene. High density polyethylene based composite are prepared silica Nanopartical obtained from many resources. High density polyethylene mixed into silica nano partical at 3 % by weight by using moulding and stirrer. The composite are compression moulded at specific time and temperature. High density polyethylene and silica Nanopartical reinforced composite have better flexural and tensile strength than other. Colom et al prepare HDPE composite using a compounding step at 200 Centigrate in crucible and moulding step at 150Centgrate in a compression Die for up to 50 minutes and 4 hours for cooling in air.

KEYWORD-HDPE, Nanopartical, Reinforcements, Composite, Fiber

I-INTRODUCTION

The objective of this study is to evaluate possible changes in high density polyethylene (HDPE) composite properties when it is reinforced with silica nanopartical reinforcements .A composite is a material resulting from the combination of two or more materials in order to optimize the properties of each component. Traditional reinforcements used in composites are common materials and do not require high technology, for example, fibers, silica and graphite . The polymer is generally viewed as the weakest link from the mechanical point of view and researchers mostly focused efforts on increasing the content of reinforcement in the final material or improving interaction with reinforcements. Nanoparticles lead to an opposite direction. Currently, we can observe an increasing use of reinforcements coming from renewable resources. Environmental issues have led to the development of biodegradable as well as traditional materials with an increasing level of additives, fillers and reinforcements from vegetable origin as well as renewable polymeric materials. The use of agricultural sub-products has been extensively studied as a source of these reinforcements . But such organic wastes have also been widely used to produce large amounts of silica. HDPE is an inexpensive commodity polymer, but its use in some engineering applications may depend on improving its properties by mould casting using Die. Basically use of radiation on the molecules of a polymer, specially for HDPE, is a method often used for modification of its properties, as it promotes a process involving simultaneously mould casting using Die.[6]

Local mechanical properties of modified-graphene high-density polyethylene nano composites are investigated using depth sensing indentation. The aim of the present study is to evaluate the effect of modified graphene on HDPE nanocomposites by means of indentation studies and generate a map of the surface mechanical properties.[7]

II-EXPERIMENTAL TECHNIQUES

Materials

We use high density polyethylene and nano particle of silica. HDPE have high density and melted at melting point 140 to 180 centigrade. When silica is melted with HDPE then silica particle fixed in cavity of HDPE.

Composite material formation with the help of HDPE in the lab with the following steps.

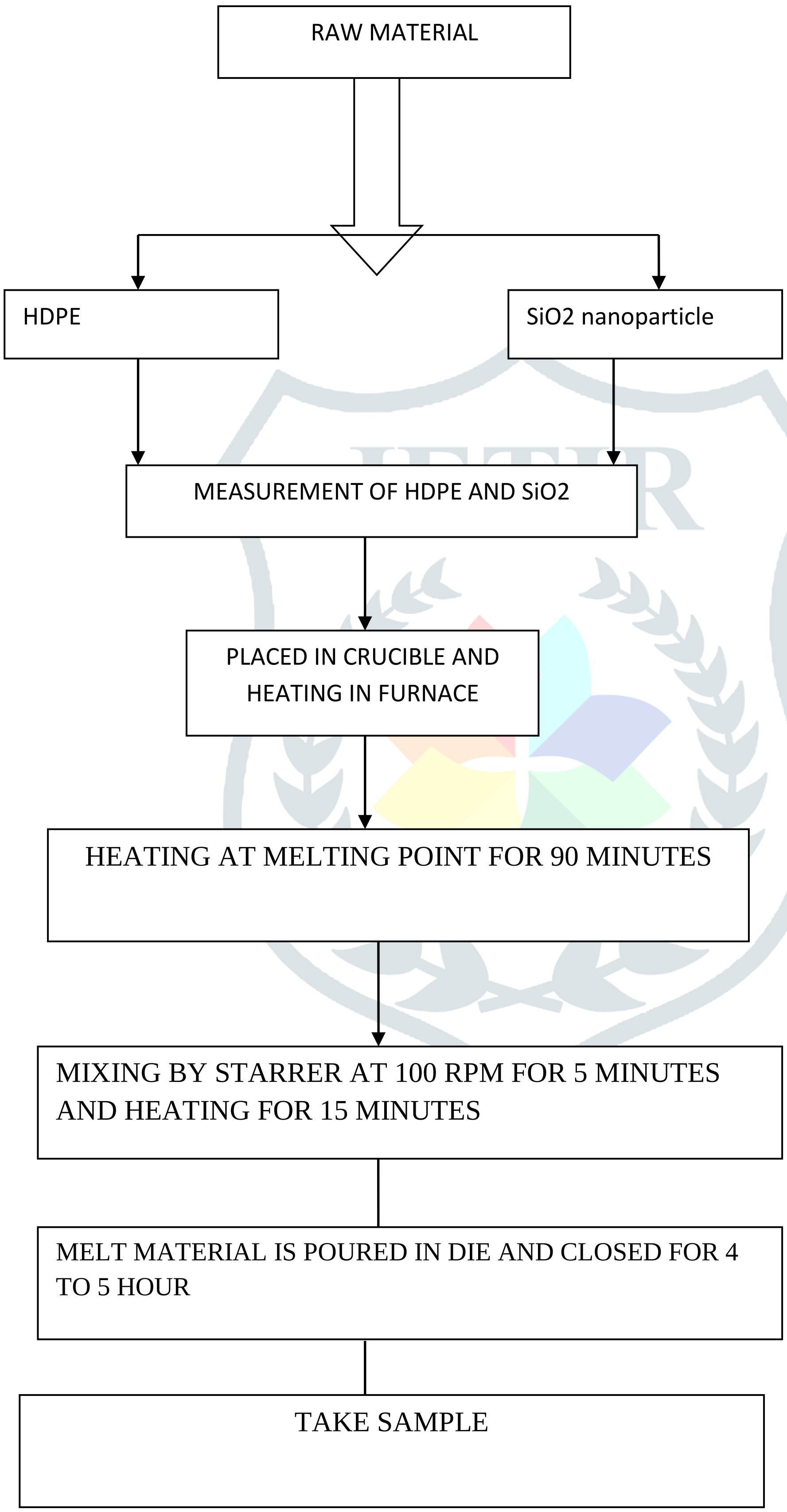
RAW MATERIAL

We are taking raw material from market. Raw materials are hdpe and nanoparticle of silica. Silica is selected for reinforcement of Hdpe. Silica have special properties for binding. So we select the silica nanoparticle.

PREPERATION OF SAMPLE

Hdpe and nano particle of silica is taken in certain ratio and measured at electronic weighing machine. It put into crucible and heated on matrix furnace at melting point. At some time it maintained temperature 200 centigrade approximate 90 minutes. We use starrer for mixing homogeneous liquid of hdpe and nanoparticle of Sio2. Starrer moves at 100 RPM for 5 minutes and then put into the furnace for 15 minutes. And die also heated at 160 centigrade. Material poured into die. It placed in air for cooling. And cooling time is 4 to 5 hour.

FLOW CHART OF PROCESS



According to standard procedure we perform test on the samples. we perform following test

i. Tensile test

ii. Flexural test

TESTING

A uniaxial tension test is used to examine the elongation behaviour of a polymer. A dog bone shape polymer sample is usually employed in this type of test. For semi-crystalline polymer such as polyethylene there are three distinct stages of deformation, as illustrated in Figure. Initially elastic behaviour before yield is represented by the first straight section of the load-displacement plot. The initial slope of the plot is a measure of the stiffness of the material . The load increases with increasing strain until yield occurs. After yield, the test sample undergoes ductile deformation or cold drawing. In the cold drawing phase, polymer chains and lamellae reorient in the direction of drawing and the load level is relatively constant until strain hardening occurs when the polymer sample is fully drawn . In strain hardening, the load increases again with increasing elongation until the material breaks. Crystalline polymers have higher stress at ultimate break than amorphous polymers due to reinforcement of crystalline regions.

Flexural test

Flexure tests are generally used to determine the flexural modulus or flexural strength of a material. A flexure test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to the top of the material through either one or two points of contact (upper loading span) until the sample fails. The maximum recorded force is the flexural strength of that particular sample. The most common purpose of a flexure test is to measure flexural strength and flexural modulus. Flexural strength is defined as the maximum stress at the outermost fiber on either the compression or tension side of the specimen.

III-RESULTS AND DISCUSSIONS

We will see the effect of reinforcement of high density polyethylene sample by testing following properties:

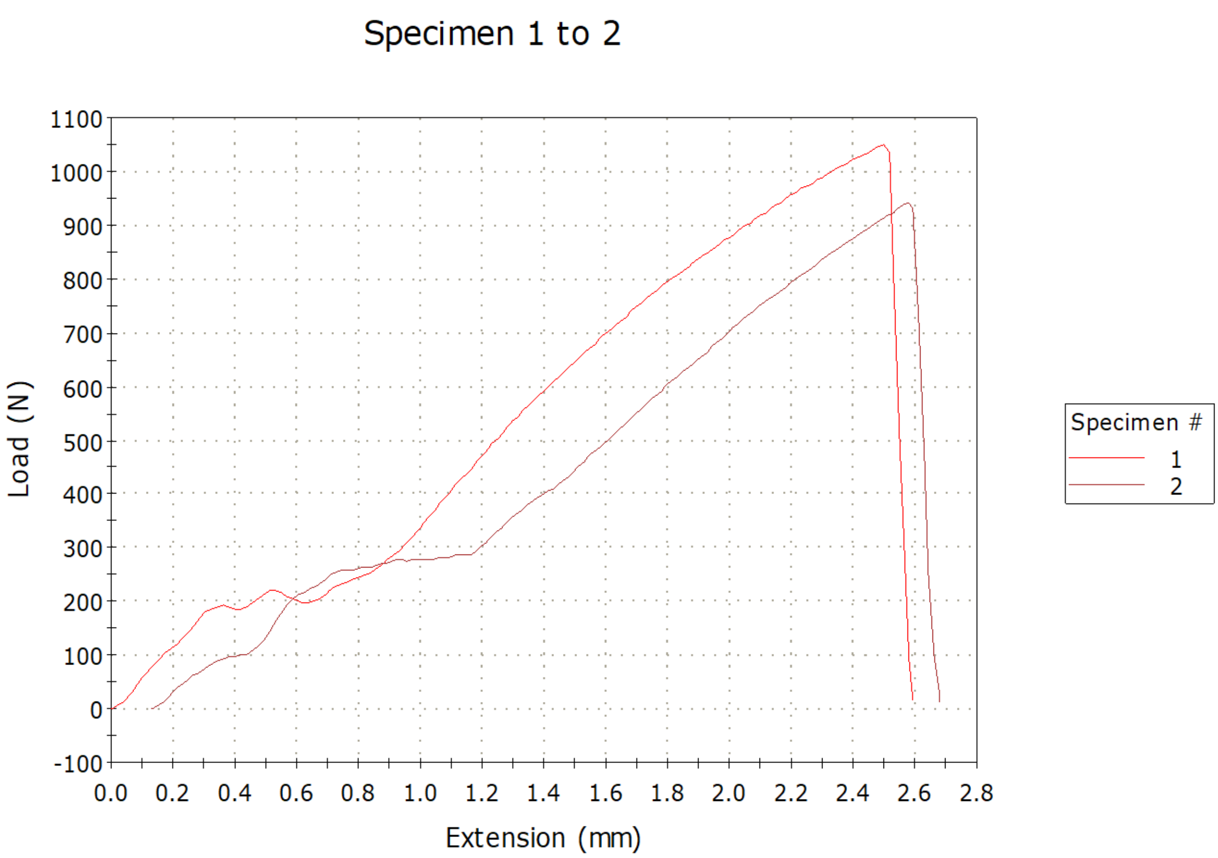
Mechanical Properties:

Tensile test

Defaults Table 4.1

Code No.	
Sample details	HDPE AND SIO2 COMPOSITE
Length	115.00000 mm
Rate 1	100.00000 mm/min
Temperature (deg C)	25.00
Humidity (%)	55.00000

Graph 4.1



Results Table 4.2

	Length (mm)	Thickness (mm)	Width (mm)	Maximum Load (N)	Tensile stress at Maximum Load (MPa)
1	115.00000	6.50000	12.90000	1050.80	12.5
2	115.00000	6.50000	12.90000	941.95	11.2
Maximum	115.00000	6.50000	12.90000	1050.80	12.5
Minimum	115.00000	6.50000	12.90000	941.95	11.2
Mean	115.00000	6.50000	12.90000	996.38	11.9

FLAXURAL TEST RESULT

Test: Rate 1	2.77000 mm/min
Text Inputs: Sample details	HDPE & Nano particle of Sio2
Number Inputs: Temperature (C)	18.00
Number Inputs: Humidity (%)	50.00

TABLE 4.2

	Maximum Load (N)	Flex Modulus (MPa)	Width (mm)	Thickness (mm)	Support span (mm)
1	73.20	666.50	13.00	6.50	104.00
2	62.07	644.07	13.00	6.50	104.00
Maximum	73.20	666.50	13.00	6.50	104.00
Minimum	62.07	644.07	13.00	6.50	104.00
Mean	67.63	655.29	13.00	6.50	104.00

With the results of tensile test and flexural test we can conclude that tensile and flexural property of hdpe**,** nano silica give positive effect. We can see that when we use hdpe in pure form It have slightly low properties but when we used with silica it gives better performance.

Incorporation of nano-SiO, particles that are pre-treated by graft polymerization into HDPE is an effective way to improve some mechanical properties of the matrix. Such an improvement can be acquired at a nano-SiO, content as low as 0.75 ~01%. Depending upon the structural nature of the polymers, the mechanical response of the modified nanoparticles composites behaves differently, especially when elongation to break is taken into consideration. The key issue lies in the specific viscoelastic feature of the interphase and the matching of properties of the components. It factually demonstrates the feasibility **of** tailoring composite performance. comparison with the case where no cross linking is carried out. However, toughness of the composites is somewhat deteriorated accordingly, because of the reduced plastic deformation ability of the inter phase. Such an improvement can be acquired at a nano-SiO, content as low as 0.75 ~01%. Depending upon the structural nature of the hdpe polymers, the mechanical response of the modified nanoparticles composites behaves differently, especially when elongation to break is taken into consideration. The key issue lies in the specific viscoelastic feature of the interphase and the matching of properties of the components. It factually demonstrates the feasibility of tailoring composite performance. Cross linking of the concentrated master batches of SiO,/HDPE helps build up a rigid and strong interphase in the composites. This is able to further enhance the stiffness and strength of the composites in comparison with the case where no cross linking is carried out. However, toughness of the composites is somewhat deteriorated accordingly, because of the reduced plastic deformation ability of the interphase.Silica increases tensile strength and flexural strength near about 10% and 8% respectively and several more property can be increases by several additives. In table of results all the data shown. This composite is prepare in furnace.

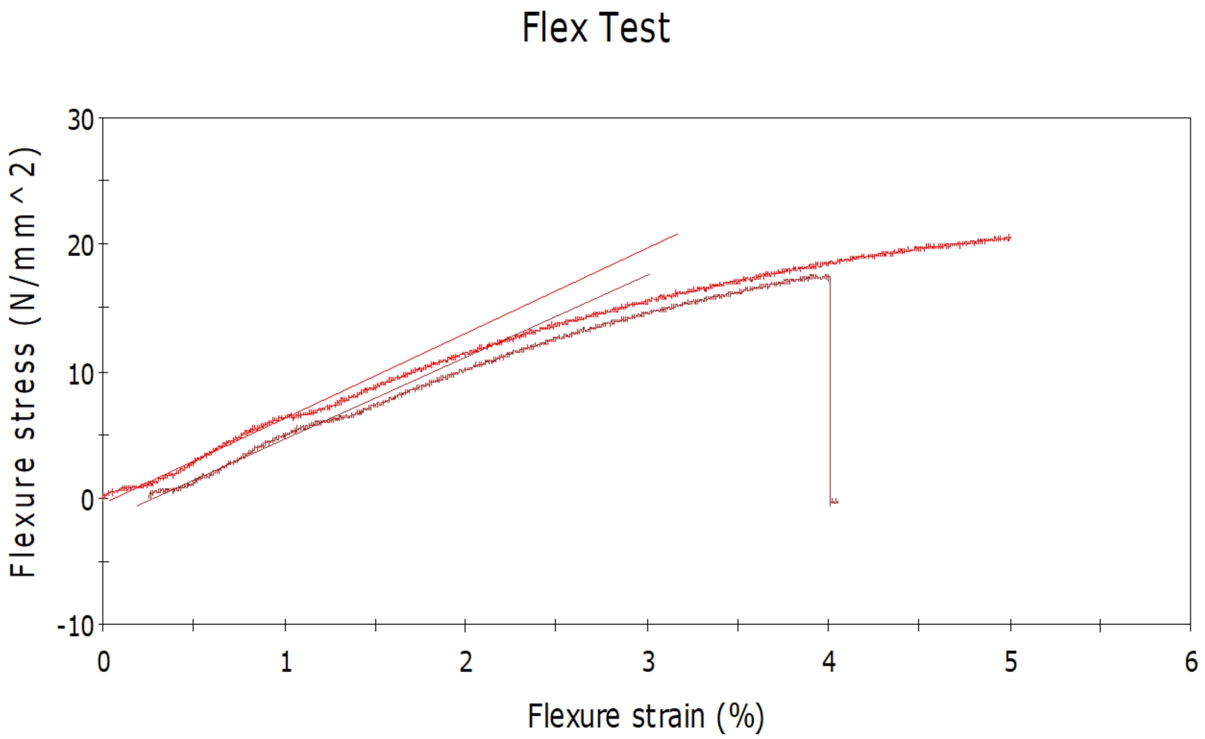


TABLE4.3

	Flexure stress at Maximum Flexure load (MPa)
1	20.78931
2	17.62826
Maximum	20.78931
Minimum	17.62826
Mean	19.20878

IV-CONCLUSION

Walnut shell flour successfully utilized to make WPCs with interesting physico-mechanical properties. The ex-perimental results indicated that the flexural properties and tensile properties of HDPE/WS flour composites improved with addition of only 2 wt% nano-SiO_2. The WA and TS of composites were lowered with the increase in nano-SiO_2 content. . Additionally, incorporation of 50 wt% WS flour improved the mechanical and physical properties of the composites better than the 40 and 60 wt% counterparts. SEM study showed that the addition of nano-SiO_2 could improve the interfacial adhesion resulting in reduced numbers of cavities and pulled-out fibers. Morphological study also showed that samples containing 2 % of spherical SiO_2 had higher order of intercalation and better dispersion of in

WPCs than those containing 4 %.The experimental results indicated that the physico-mechanical properties of HDPE based composites could be improved with an ap- propriate addition of nano-SiO_2 content and WS flour loading. . Utilization of WS in composite manufacturing not only can partially alleviate wood shortage in some walnut rich countries like Iran, but also may result in several benefits such as environmental and socioeconomic.

V-Referance

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