DESIGN AND EXPERIMENTAL ANALYSIS OF PLASTIC DEFORMATION OF NANO COMPOSITE MIXTURES WITH POLYPROPYLENE FOR DIAGNOSTIC TUBES

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Abstract:
Analysis of fluid flow in lateral NANO tube application is quite natural but the angular flow of velocity and mass flow rates have to observe to fulfil the application combination of two or more materials, which results in better properties than the individual compounds used alone, can be described as a composite material. Contrary to polymer alloys, the separate chemical, physical and mechanical characteristics of each material continue. The motion of a fluid is governed by the global laws of conservation of mass, momentum, and energy. A polymer composite NANO maximizes the scale of the polymer / part interfacial surface of the large surface area of the NANO particles. Moreover, the amount of point of contact between particles increases with decrease in particle size when percolating network is involved. Therefore, it is fair to expect the interfaces to play an important part with respect to NANO's thermal conductivity. NANO tube NANO composite samples of polypropylene have been prepared with the good NANO tubes dispersed with no organic processing of the NANO tube surfaces. Without the use of organic treatment. The thermal stability of PP in Nitrogen and Air is improved by MWNTs with the exception of $205,80^{C}$ (1080C / min heating) where oxidative thermal stability is reduced.

Key words: Advanced manufacturing, NANO composites, Polymers

1.Introduction

Carbon nanotubes, which have been discovered just over 10 years ago, have gained considerably recognition from renowned experts for their exceptional properties and their unique structure. Carbogenoidal nanotubes, or tubes that roll up graphic sheets, are an allotrop of carbon. Based on the reaction conditions, these nanotubes form either in single walled nanotubes (SWNTs) or in multi walled nanotubes (MWNTs). The nanotubes are sturdy and thermally favorable to a large extent. The electrical conductance of each tube is centered by its own design on a semiconducting to metallic conductivity. The texts include numerous papers concerning carbon nanotubes composites and polymer networks. The results show that even small nanotube measurements (< 5 WT percent) can have an effect on the composite's electrical and mechanical properties. This detailed data provides an outline of the latest writing of polymer nanotubing composites, the characteristics of and their application of carbon nanotubes. Nano composites involve at least one phase as far as nanoscale in metres. The property of nano composites is derived from the inherent nano systems used, allowing drastic modifications to the composite characteristics with just a small number of preparations for the final. One of the most significant Nano inclusions is carbon nano tubes.

Scope Of Work

As discussed in the organizational systems, the role in the tube creation was crucial by using the devices as one. Further analysis must be done in order to strengthen the framework for economic solution for the future, with respect to the mechanical and thermal elements of the produced product.

Considering the complexity of individual CNTs, the comportability and the creation of material binding must be investigated in order to create economical applications of solely nano-material in order to increase the use of nano-materials directly made by a polymer researcher.

Objectives

1. To execute the fabrication process in a proper way of mixing CNTs with polymers.
2. To analyse the micro structural analysis of fabricated CNT polymer composite to check internal bonding and flow of fabricated composite.
3. To estimate the thermal and mechanical properties of CNT –polymer composite.
4. To analyse the CNT-polymer tube by observing fluid flow with different fluids to check internal surface quality of fabrication.
5. To establish the interface thermal conductivity of CNT polymer for better results.

2. LITERATURE REVIEW

Mamalis et.al [1] The preparation, ratio and use of carbon nanotubes has been documented. The research discusses several forms of CNT manufacturing, such as electrical discharge, laser reduction, and chemical absorption by vapour. Meixner, Forta [2] The increasing of the individual CNT 's comparison with that of CNT wood produced from unpatented films reveals the influence of the effect of temperature, production time, volume weight and strength in terms of growth parameters. Adebola et.al [3] Due to their smaller articulated and nano-roast acteristics relevant to the high surface area, electro-spun nanofibers offer another and increasingly increasing inspection area. Poly (styrene-cocryl amide) and polystyrene polymers were combined in the fluid medium with potassium peroxosulfate as the initiator using a blast temperature cleanser free emulsion polymerization. Amrinder Nain et.al [4] The large-scale development of nanoscale constructions, devices and structures is one of the main obstacles to achieving the milestones promised with nanotech. The three-dimensional modified assemblage of smaller scale / nano-filaments is one of the big obstacles for non-fabrication frames. Avouris et.al [5] In directing this transition the nano-tubes play an significant role, in a special type of carbon molecule called the nano-tube, are carbon-micron-long and nanometer-thick pipes, which have demonstrated excellent electric and thermal conductivity. Birendra Pratap Singh et.al [6] Materials of this form have other essential properties, such as linear and electrical, nanocomposite electronic and conducting polymer, and have mechanical characteristics, safety and security of the material. Byung Gil Min, Han Gi Chae [7] Carbon nanotubes have remarkably anisotropical mechanical, electrical, and thermal properties. A variety of composite carbon NANO tube / polymer filaments is produced and this carbon tube capacities are tested such that they have a significant effect on polymer and fiber handling, and composite filaments are prepared using rotating structures, soft rotating and even elektro-turning. Ducati and Robertson [8] agree that plasma-enhanced chemical vapor deposition has created carbon nanotubes at temperatures as low as 120 ° C. A systematic research is performed using the C2H2 / NH3 method and nickel to determine the temperature dependency of the rate of growth and the composition of the formed nanotubes. This proposes that the surface distribution of carbon to nickel be used for growth. Hu and Feng [9] The covalent and non-covalent modification of CNT was stated by attached carboxy group on the sides of the walls and ends at CNT. The TEM images confirmed the well-distribution of the 200-800 nm long CNT. SEM pictures have confirmed the carboxyl group's covalent bond at the ends. Robeson [10] Nano composites based on polymer matrices from have been a popular part of current R&D. The polymer literature covers exfoliated clay-based nano composites but there are several other important fields of present and evolving significance. Demetra et.al [11] monohybrid matériaux have drawn a particular scientific technical curiosity, as they are connected with the natural and inorganic component properties of inorganic nanoparticles, but with their high volume surface-to - volume ratios, they are constantly exhibiting electrical, mechanical, appealing or theoretically catalytic properties.Arockia Jaswin, [12] Carbon nanotubes (CNTs) are becoming increasingly aware of reinforced aluminum composite composites (Al). Due to its high efficiency, high angle ratio and repair properties, carbon nanotube scans can be found ideally reinforced.

3. MATERIALS AND METHODS

In approach, work into the development of carbon nanotube polymers by taking note of the production of layers on arrangements to test their achievability without wasting the material for future generations.

Basic Principle of Rapid Prototyping Processes

The rapid prototyping technique is used in the design of a product to construct a 3-D model of an element or part. In addition to providing 3-D perception of careful rendering of artifacts, rapid Prototyping may be used to evaluate specific design components or product usability, especially prior to assembly. Testing can be on size , weight, consistency, intensity or other contours. The explanation for this pattern may be an invisible substance of its type that was finished until manufacturing. Encouraging the technique has a place-forming process, for instance, in which the components are created by deposition or production of plastics substance, laying, refining, granulation or authoring.

Layer Deposition Modeling

In the process of Fused Deposition Modeling (FDM), a mobile (x-y-development) stretches liquid chain from the polymer substrate onto a substratum. The substance is heated marginally higher (approximately 0.50 C), so that it hardens within a small period (approximately 0.1s) after expulsion and chilly welds to the past layer, as seen in Fig

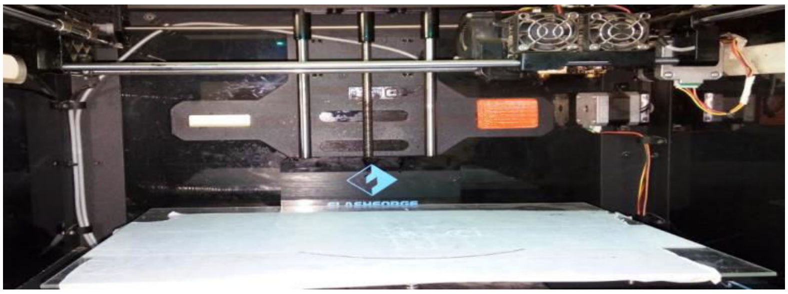

Figure 1: Rapid Prototyping System

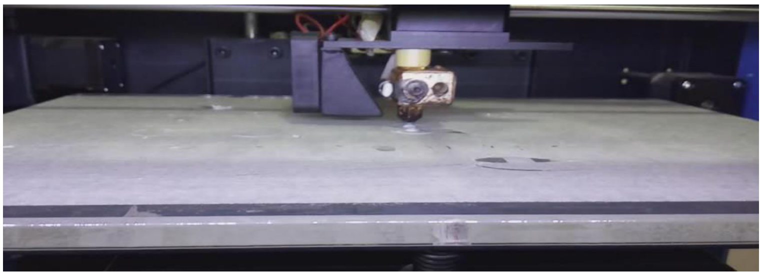

Figure 2: Layer Deposition Modeling Process

CAD MODELING

CAD is the use of software structures to help develop, modify, analyze and streamline a program. Software helps describe CAD. Computer-aided design programming is used to optimize the originator 's performance, allow the setup, boost knowledge interchanges, and create a database for assembly. The computer-aided design outputs are often written, machined or assembled as electronic papers. Additionally, the word

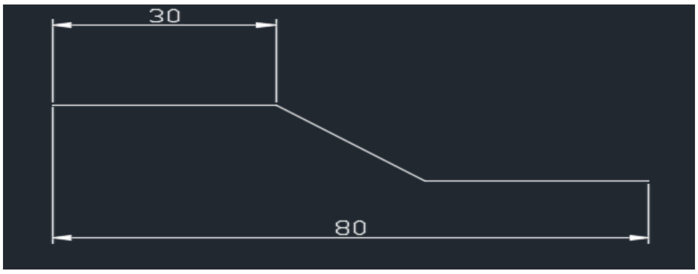

Figure 3: Layout of the lined tube

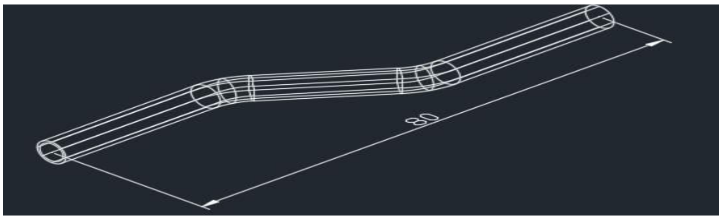

Figure 4: Layout Layer material deposition

The module transforms into a three-dimensional structure over two-dimensional diagram. The Design Module is known to have the extra favorite perspective in NC applications, which means STL drawing or three-dimensional drawings, from the key modules that are used by the developer.

Table 1: Composite mixing and extrusion percentages

S. No	Material name	Raw material (mg)	CNT (mg)
1	PP with 0.1 % CNT	584	6
2	PP with 0.2% CNT	578	12
3	ABS with 0.1% CNT	594	6
4	ABS with 0.2% CNT	588	12

4.0 RESULTS AND DISCUSSIONS

In addition to the primary material which is equal to the melting temperature of the polymer and layers the polymer material input and the Carbon nanotubes are added at 0.1 and 0.2 per cent according to the input ratio defined in the technique and the whole process performed with good results and the prototype shown in Figure.

Figure 5: Fabricated product of polymer CNT

The polymers PP and ABS mixed 0.1% and 0.2% of CNT ratios. Spray methods as well as methods for deposition and formulation of layer materials for manufacturing tubes to achieve a realistic and simulated performance increase. The rods have been tested to produce greater positive results for structural stability.

Table 2: Mechanical properties of fabricated CNT polymer tube

CNT %	Modulus [Gpa]	Strength [Mpa]	Failure Strain%
0.1% add to PP	2.45	109	6.06
0.2% add to PP	2.64	115	6.80
0.1% add to ABS	2.60	113	5.12
0.2% add to ABS	2.73	121	7.52

Table 3: Thermal properties of fabricated polymer tubes

S. No	Sample	Operating Temperature Range K	Thermal stability K
1	0.1% CNT + PP	313-393	<500
2	0.2% CNT + PP	313-413	<500
3	0.1% CNT + ABS	313-393	<500
4	0.2% CNT + ABS	313-413	<500

The above tabular form presents the detailed test results of 0.1 percent CNT and 0.2 percent CNT of PP, which are required in operational temperature and thermal stability.

Table 4: Test results of 0.2 % CNT Poly Propylene tube

S.NO	Test	Test method	Result	Unit
1	Tensile strength at yield	DIN-53455	41.2	N/mm^2
2	Elongation at break	DIN-53455	390	%
3	Specific gravity	DIN-53479	0.9381	-
4	Shore d hardness	DIN-53505	70.0	-
5	Impact strength	DIN-53453	151.39	mj/mm^2
6	Abrasion resistance	ASTM D-1044	68.4	Mg
7	Breaking strength	DIN-53455	36.19	N/mm^2
8	Compression strength	DIN-534551	24.07	N/mm^2
9	Bending strength	DIN-53455	24.89	N/mm^2
10	Co-efficient of friction	DIN-53375		
A	Static		0.14	
B	Kinetic		0.11	
11	Torsion strength at 23°c	DIN-53477	263.63	N/mm^2

The above table shows the test results of 0,2 percent of PP under a variety of conditions including traction power, elongation, friction coefficient, bending strength, torque strength, static and kinetic frictions, etc. The large nanoparticle surface of a polymer nano composite maximizes the size of the interface region of the polymer / particle. In addition, the number of contact points between particles increases with decreasing particle size for percolating network conditions. It is therefore fair to expect the thermal conductivity of nano-composites to have a major role of the interfaces.

4.4 SIMULATION RESULTS

The optimal test results, the enhancement of the PP with 0.2 percent CNT, are approximately identical in comparison with the composite matrix so that the simulation must be observed with the aid of advanced ANSYS FLUET software, for fluid flow inside the tunnel.Two different fluids with different viscous properties were studied, which are water and diesel.

Inlet Boundary condition

Inlet mass flow rate (kg/s)	-	0.000744
Inlet Temperature (K)	-	300^0
Turbulence Intensity (%)	-	10
Turbulent Length Scale(m)	-	9

Outlet Boundary condition

Gauge pressure (Pa)	-	-50662.5
Back Flow Turbulent Intensity (%)	-	10
Back Flow Hydraulic Diameter (m)	-	9
Outlet temperature (K)	-	300

Boundary assignment for a specification of a fluid continuum form to an object in volume; model is specified such that equations of momentum, continuity and transport of species apply within the volume to the mesh nodes or cells. Conversely, only energy and species transport equations (without convection) apply on mesh nodes or cells that occur within the volume, when a solid continuum form specification is assigned to a volume instrument.

PP (Poly Propylene with 0.2 % CNT) with water as fluid

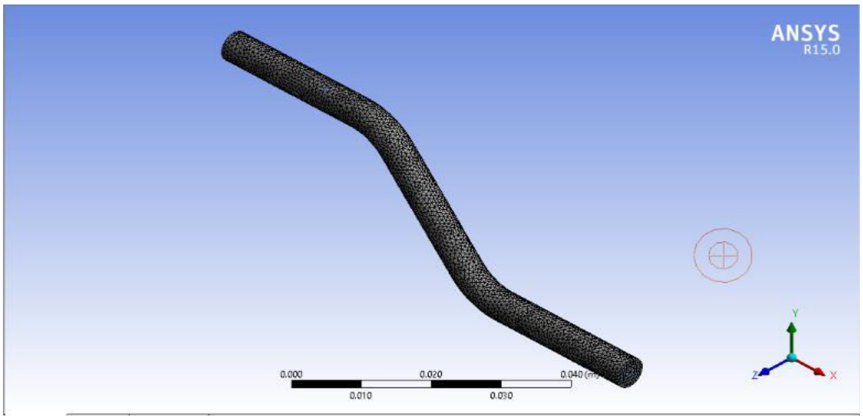

Figure 6: Meshing of the object PP with 0.2% CNT

The figure above shows a fluid mesh for the PP vapor. The meshing is achieved such that the load is evenly distributed during the meshing cycle on the pipe such that maximum deformation exists.

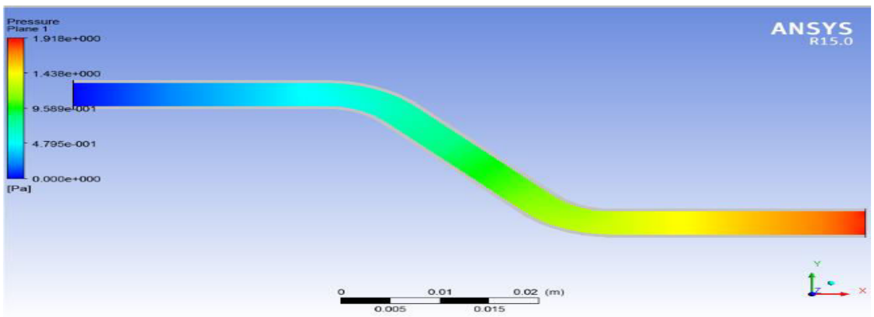

Figure 7: Pressure flow along 0.2% CNT Poly Propylene tube

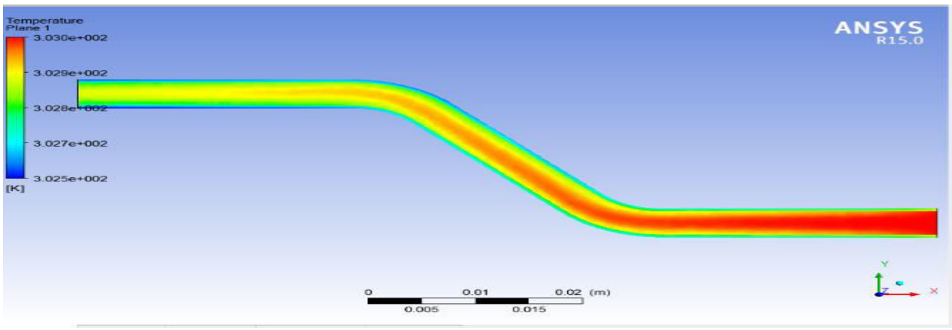

Figure 8: Temperature inlet vector of 0.2% CNT Poly Propylene tube

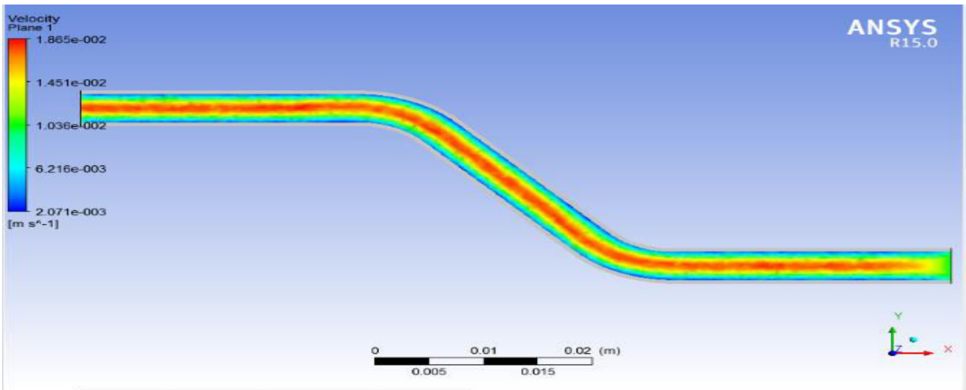

Figure 9: Velocity flow of fluid along 0.2% CNT Poly Propylene tube

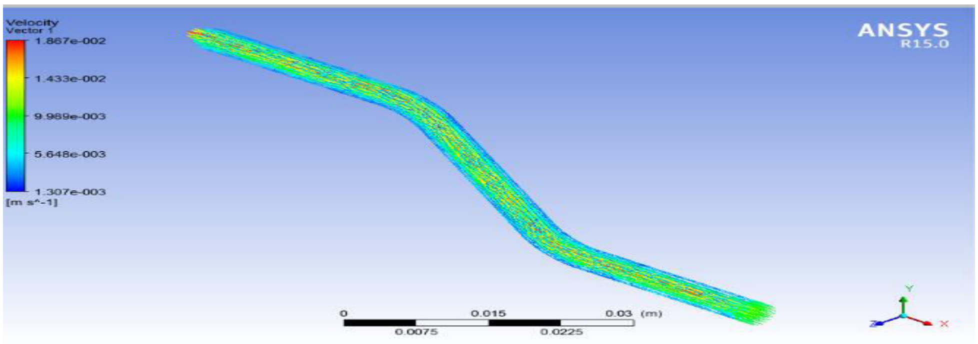

Figure 10: Velocity vector of 0.2% CNT Poly Propylene tube in x-direction

ABS With 0.2 Percent CNT and Water as Fluid

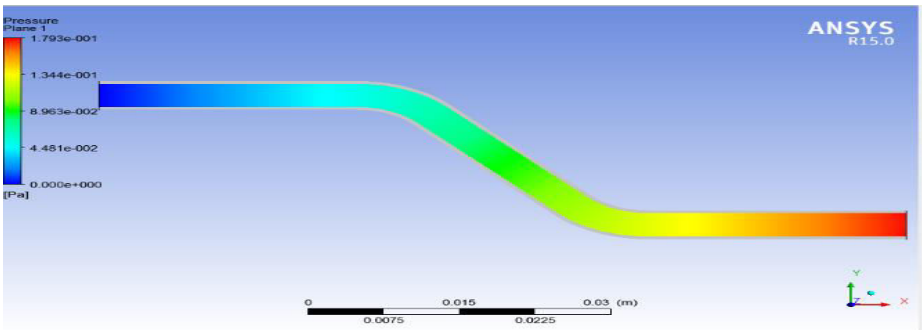

Figure 11: Pressure inlet along x-direction in 0.2% CNT ABS tube

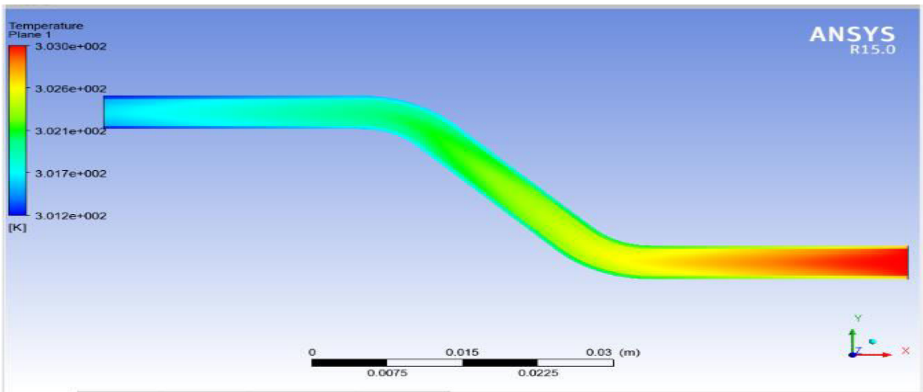

Figure 12: Temperature inlet along x-direction in 0.2% CNT ABS tube

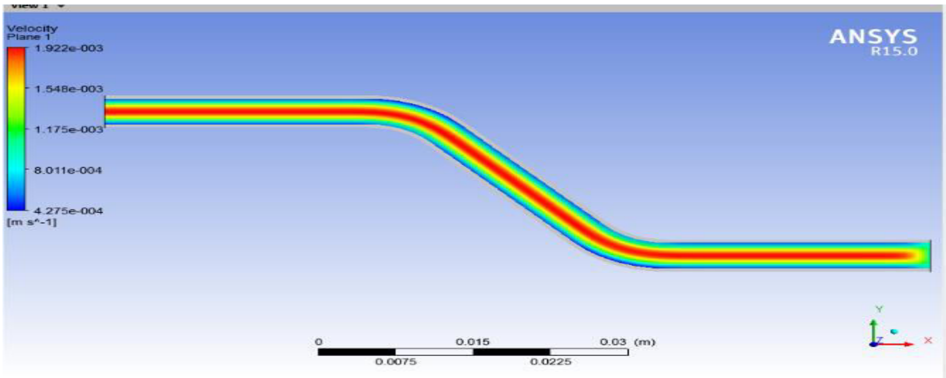

Figure 13: Continuous Velocity along x-direction in 0.2% CNT ABS tube

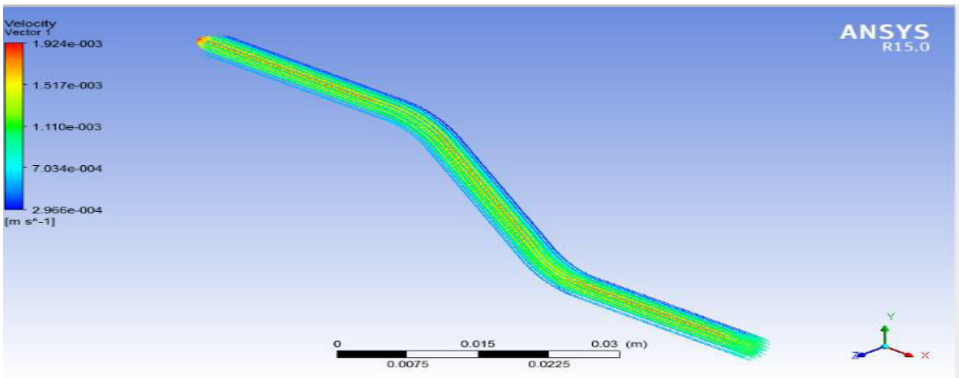

Figure 14: Velocity streamline in X- direction in 0.2% CNT ABS tube

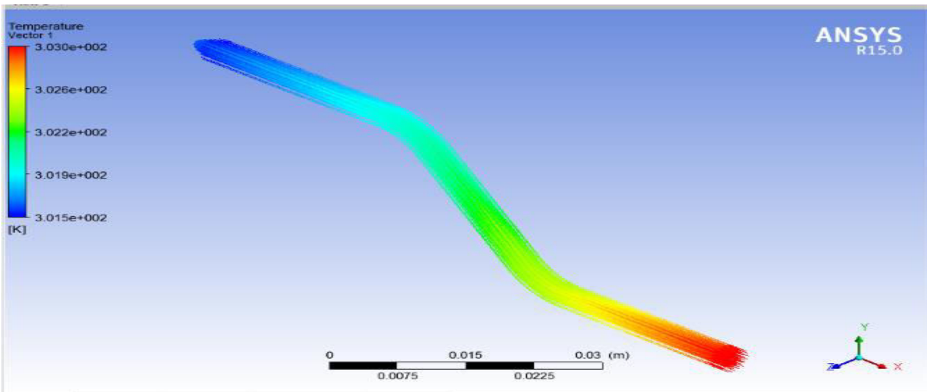

Figure 15: Temperature steam line in X-directions in 0.2% CNT ABS tube

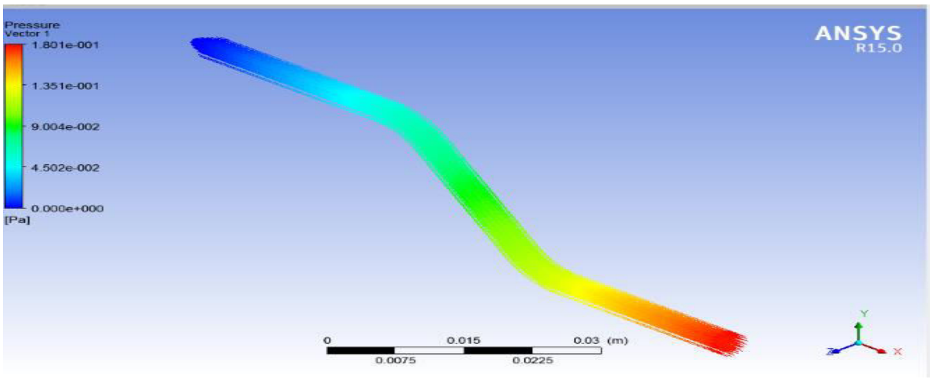

Figure 16: Pressure vector along x-direction in 0.2% CNT ABS tube

Table 5: Maximum Input and Output Temperatures

S. No	Material	Type of fluid	Maximum temperature input K	Outlet temperature K
1	PP	Water	303	301
2	PP	Diesel	303	302
4	ABS	Water	303	301
5	ABS	Diesel	303	302

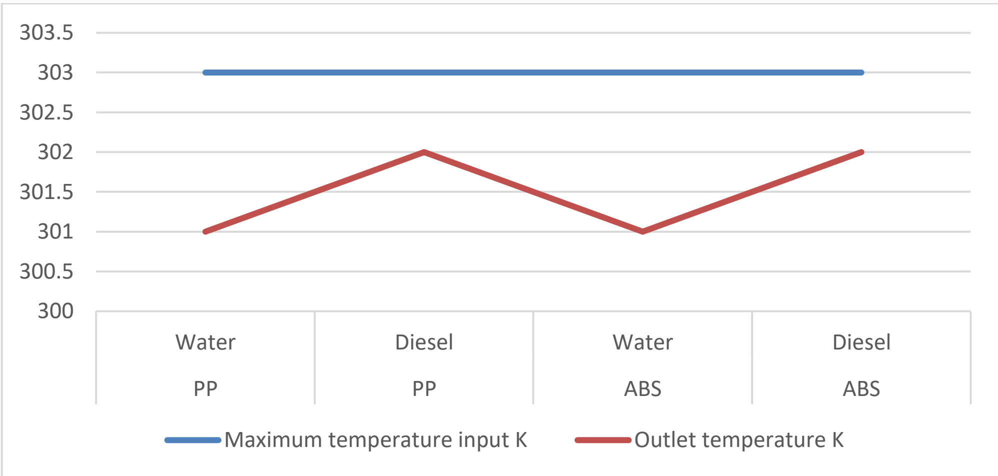

Figure 17: Maximum Input and Output Temperatures

The table above shows the average input and outlet temperatures for PP & ABS materials in various fluids such as water and diesel The average input temperature in all conditions is the same and varies during outlet. A stream line flux was shown with a continuous flow in both materials by testing the fluid flow and temperature variants. Considerable points were made about the fining of PP material for various fluids for further applications in interface geometry.

Conclusion & Future Scope

By practical as well as simulation analysis observed at the time of research the following conclusions made with obtained results.

- It has also attempted to integrate some of the important considerations which need to be taken into account before taking part in the filing process for the proper usage of RP capacities.

- Even though stitching can be very good for some applications, there may be problems with the difference between the properties of stitching materials, such as microcracking.
- Practical results show that PP 's intensity with 0.2 percent CNT variation has similar effects.
- The solution implementations often studied with CFD solution in different fields.
- Optimize the resin carbon nanotube in compliance with the application of thermal conductivity measures such as heat and CFD approaches to fluid fluxes.
- The goal is clearly seen from the manufacture of layered formation tubes and the properties evaluated by the testing of tubes that PP is regarded as the key research object for the thermal modeling preparation.
- Layer technologies for simulation modeling of 10 layers considering the thickness of the NANO layer by 0.05. Structural stability in experiments of various approach methods until the simulation model is completed.
- Pressure and speed of the fluids in both pp and abs tubes have been shown to achieve streamlines of fluid flow without barriers and speed, pressure changes. pressure differences have been observed.
- The heating penetration is less than metals and the processing equipment, as can be found in simulations as well, due to the thermal conductivity of the system.

Future Scope

A stage in the application of the substitution of MMCs with NANO composite CNT polymers again involves a lot of optimisation under different conditions. Any of them can be described below.

1. Different polymer materials may take in to consideration as further objectives.
2. Manufacturing methods of tube formations may increase elaborated discussion.
3. Specific applications may consider as work probability.
4. Optimization process consideration can show a broad way of further research.

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