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ANALYSIS OF MECHANICAL PROPERTIES AND STUDY OF MICROSTRUCTURE (HDPE) PLASTIC MADE BOAT

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Abstract

HDPE plastic boats are buoyant devices made from high-density polyethylene (HDPE) plastic. They are commonly used in various marine applications such as aquaculture, dredging, and offshore drilling. HDPE plastic boats are designed to provide buoyancy and stability to objects and structures in water, helping to keep them afloat and prevent them from sinking. A 360-degree boat steering refers to the ability of a boat's steering system to rotate the boat's outboard motor or stern drive in a complete circle, allowing for easy and precise manoeuvring in all directions. This steering system allows for improved control of the boat, especially in tight spaces, such as marinas, docks, and canals. The system typically includes a steering wheel, which is connected to a mechanical linkage that transmits the driver's input to the boat's motor or stern drive. Overall, 360-degree boat steering is an important feature for any boater, as it can help to make docking, manoeuvring, and navigating in tight spaces much easier and more efficient. The concept of generating free energy using a turbine on a river crossing involves harnessing the kinetic energy of the flowing water to produce electricity. This idea has gained increasing attention as a sustainable source of renewable energy.

Keywords: HDPE boat, 360-degree boat steering, Kinetic energy.

I. Introduction

It is technically possible to generate free energy using a turbine in an HDPE boat with 360 degree steering. However, there are several factors that need to be considered to determine the feasibility of this idea. Firstly, the size of the turbine and the flow rate of water would determine the amount of energy that could be generated. The turbine would need to be appropriately sized and designed to generate a sufficient amount of energy to power the steering system as well as any other systems on the boat.

Secondly, the design of the boat would need to be carefully considered to ensure that the turbine does not interfere with the steering or propulsion of the boat. Additionally, the weight of the turbine and associated equipment would need to be taken into account to ensure that the boat remains stable and does not capsize.

Finally, it is important to note that the concept of generating free energy is not scientifically accurate. While energy can be converted from one form to another, it cannot be created or destroyed. Therefore, any energy generated by the turbine would ultimately come from the kinetic energy of the water, which would be converted into electrical energy by the turbine. This energy would not be "free", as it would be derived from the movement of the boat and the water around it.

In summary, while it is technically possible to generate energy using a turbine on an HDPE boat with 360 degree steering, careful consideration would need to be given to the design and feasibility of the concept. Additionally, the energy generated by the turbine would not be "free", as it would ultimately come from the movement of the water and the boat.

II. Materials and Methodology

2.1 Material

High-Density Polyethylene (HDPE) is a thermoplastic material that is widely used in the marine industry to manufacture boats due to its excellent mechanical properties and low cost. In this analysis, we will discuss the mechanical properties and microstructure of an HDPE plastic made boat.

Table1.Properties of HDPE

Parameter	Value
Density	0.954g/cm3
Elastic modulus (short term: 1 min)	1.0 × 10^3 MPa
Ultimate tensile strength	26 MPa
Breaking elongation	750%
Brittle temperature	≤-94˚F(-70˚C)
Working temperature	-112˚F(-80˚C) ≈ 212˚F(100˚C)
Thermal conductivity	0.29 kcal/m.hr˚C
Service life	>50 years

Figure1.Universal Digital Tensile Strength Tester Machine

Specification:

- Capacity: 500 Kgf / 250Kgf.
- Accuracy: 0.100 Kg (100g)
- Display Unit: N/mm2, kgf/Cm2.

Turbine-The concept of generating free energy using a turbine on a river crossing involves harnessing the kinetic energy of the flowing water to produce electricity. This idea has gainedincreasing attention as a sustainable source of renewable energy.

2.2 Methodology

Designing an HDPE (High-Density Polyethylene) boat with a 360-degree turbine system to generate free energy requires a systematic approach. Here is a basic methodology that could be followed:

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Define the boat's purpose: Determine the primary function of the boat, whether it is for transportation, fishing, or recreation, and the size of the boat required.

1. Select the HDPE material: HDPE is a strong and durable material that can withstand harsh marine environments. Choose the appropriate HDPE material that meets the boat's requirements.
2. Determine the turbine system's size and location: The turbine system should be sized based on the boat's purpose and the desired amount of energy production. The turbine system should also be located in a way that maximizes the energy output.
3. Select the appropriate turbine technology: There are several types of turbines available, such as axial flow, radial flow, and mixed flow turbines. The appropriate type of turbine technology should be selected based on the boat's requirements.
4. Design the hull and mounting structure: The hull and mounting structure should be designed to accommodate the turbine system and ensure that it is securely mounted to the boat.
5. Determine the power generation and storage system: The generated energy needs to be stored in a battery or capacitor to power the boat's electrical systems. The power generation and storage system should be designed to ensure maximum efficiency and safety.

   Test and refine: Once the boat is built, it should be tested to ensure that the turbine system is generating the expected amount of energy. Any necessary refinements should be made to improve the system's efficiency and safety.

Overall, designing an HDPE boat with a 360-degree turbine system to generate free energy requires careful planning and attention to detail. With the proper methodology and expertise, it is possible to create a functional and efficient energy-generating boat.

Table 2. Process parameters

Process Parameters	Specimen 1	Specimen 2
Diameter(mm)	20	26
Ultimate load(N)	2300	2220
Initial diameter(mm)	12.77	12.77

III. DESIGN

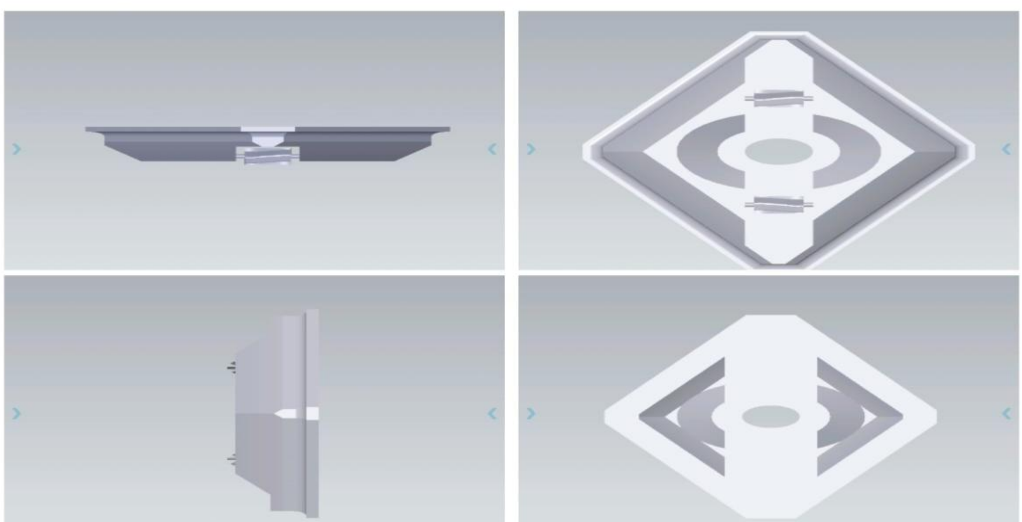

Figure 2. Design of HDPE boat

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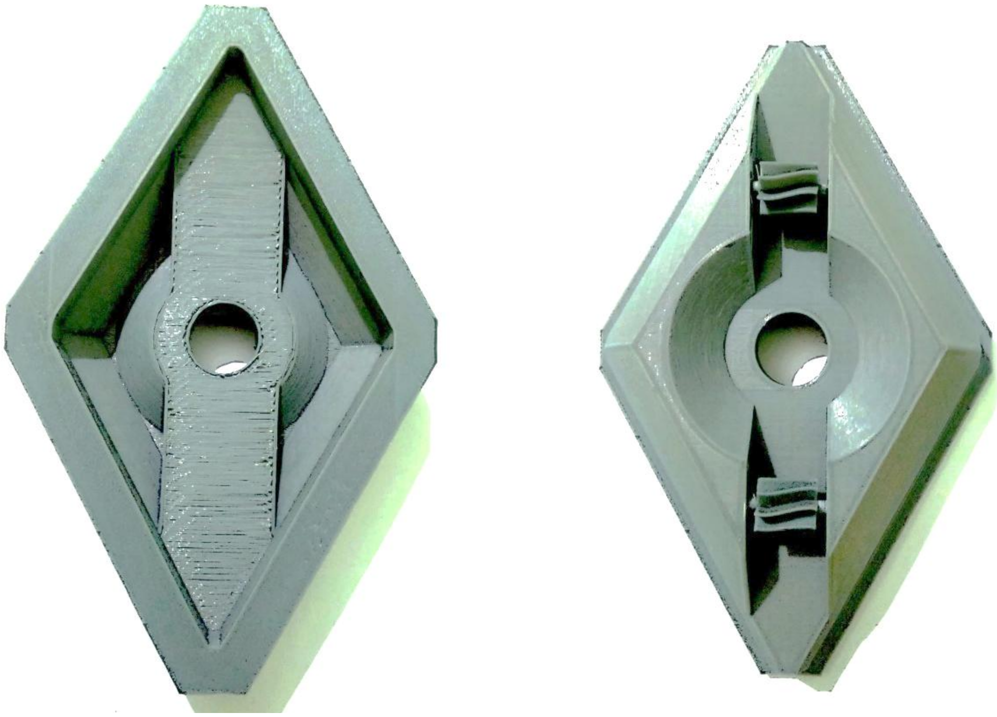

Figure 3.Prototype of HDPE boat

IV.Result and Discussion

4.1 Tensile Test

The tensile strength of HDPE is a measure of its ability to resist deformation under tension. It is typically measured in units of force per unit area, such as MPa or psi. Tensile strength can be calculated by dividing the maximum load applied during a tensile test by the cross-sectional area of the sample.

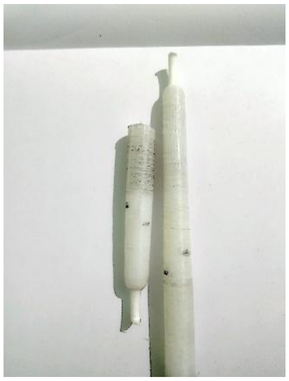

Figure 4. Tensile specimen

TENSILE STRENGTH Test method – ASTM D 2240
Test Speed: 1mm/min

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Table 3. Specimen Properties

Initial Diameter(mm)	12.77
Initial Thickness(mm)	0
Initial Height(mm)	0
Initial Gauge(mm)	54
Initial Area(mm^2)	128.14
Final Gauge Length	104
Final Diameter(mm)	5.06
gFinal Area(mm^2)	20.12

Table 4. Analysis Data

Yield Load (N)	0
Ultimate Load (N)	2300
Breaking Load (N)	1260
Yield Stress (N/mm^2)	0
Ultimate Stress (N/mm^2)	17.95
Breaking Stress (N/mm^2)	9.83
% of Elongation	92.59
% of Reduction	84.3

Deformation graph:

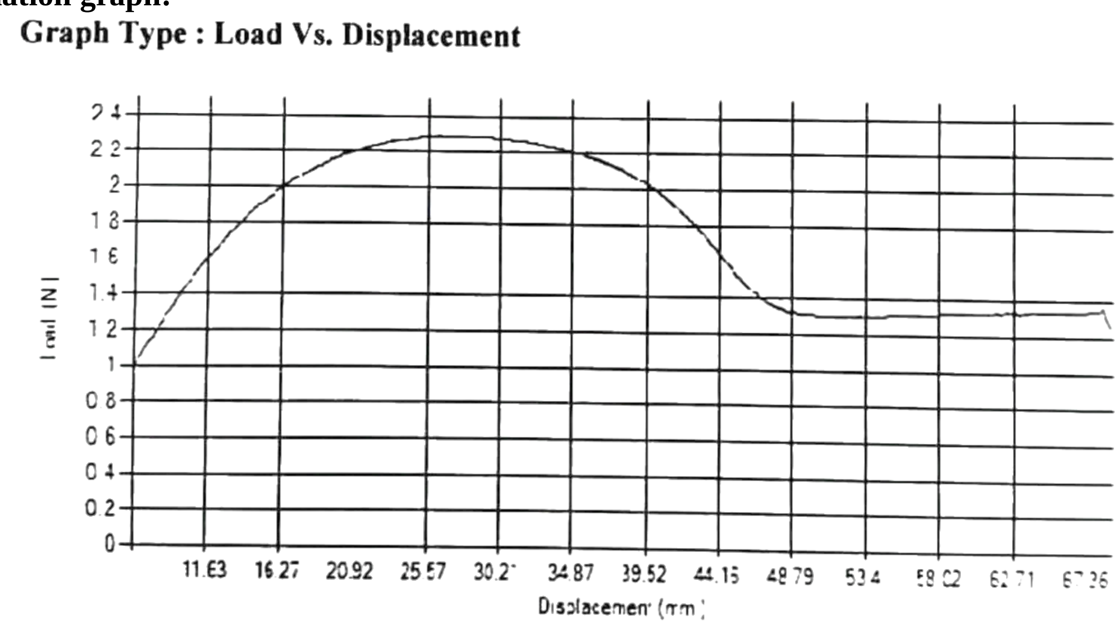

Figure 5. Deformation graph

4.2 Microstructure Test

In the microstructure examination optical microscope was used to examine different specimens of metallic and non-metallic materials. From the examination, the grain boundary size was calculated. And the sketch of a sample under microscopic view is provided in the report. The purpose of this experiment was to inspect the microstructures of different materials.

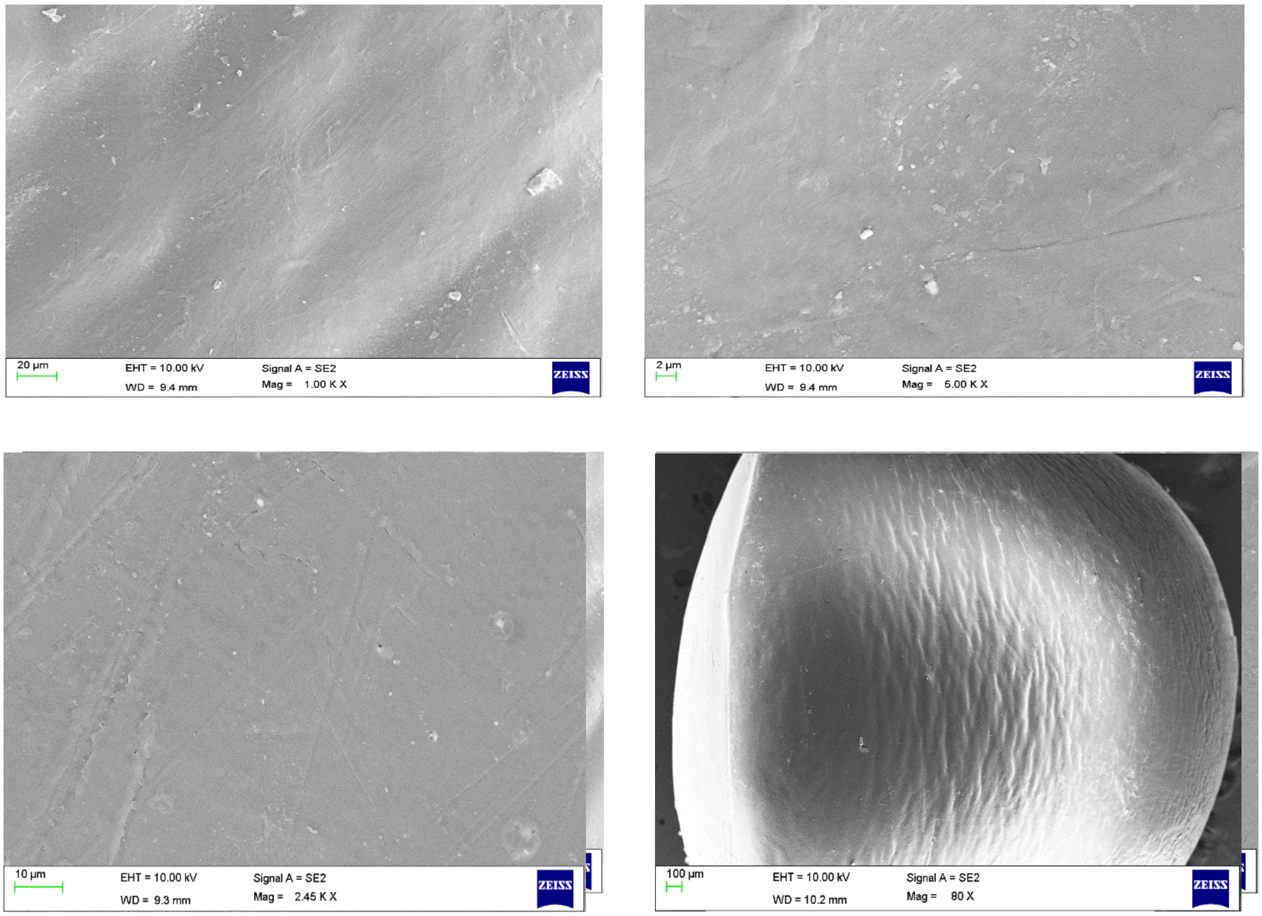

Figure 6.Specimen microstructure

V. Conclusion

The analysis of mechanical properties and study of microstructure of HDPE plastic made boats revealed several key findings. HDPE plastic material showed high tensile strength, good impact resistance, and excellent flexibility. The microstructure of the HDPE material exhibited a homogenous distribution of polymer chains with a crystalline structure, which accounted for its excellent mechanical properties making them ideal for use in marine environments .Additionally, the examination of the microstructure of HDPE plastic revealed a homogenous distribution of polymer chains with a relatively high degree of crystallinity, contributing to the material's stiffness and strength. Furthermore, the presence of small voids or pores in the plastic matrix could lead to localized stress concentration and ultimately affect the overall mechanical performance of the boat. Overall, the combination of analysing mechanical properties and studying microstructure provides a comprehensive understanding of HDPE plastic's behaviour and performance in marine applications. This knowledge can be used to optimize boat design, improve production processes, and enhance the overall quality and durability of HDPE boats.

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