iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** II **Month of publication:** February 2022

DOI: https://doi.org/10.22214/ijraset.2022.40464

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue II Feb 2022- Available at www.ijraset.com

Fabrication of All-Terrain Vehicle

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Abstract: This study is aimed to deal with the Fabrication and Testing of an ATV (All-Terrain Vehicle) Frame. An ATV is developed to run on various terrains such as soil, gravel, pebbles, etc. Considering this our major focus was to maintain drivers' safety and better performance of the machine simultaneously. In order to achieve proper parameters, satisfy driver safety, and reduce weight correct alternative of material was required to be concluded. To ensure this, we have conducted several crash tests for drivers' safety and made the required modifications.

I. INTRODUCTION

ATV, an All-terrain vehicle is manufacture to perform in different types of terrain than other vehicles. The major objective of our project is to fabricate and test an ATV and view its versatility, safety, durability, and high performance like an off-road vehicle. The fabrication of this ATV is based on the principles mentioned in the rule book of SAE BAJA which provides their knowledge in the sector of automotive. We will develop an all-terrain vehicle that meets international standards and is also cost-effective and try to optimize every parameter considering its effects on the performance of another component of the vehicle. Our project is confined only to the fabrication and testing(crash) of chassis (Roll cage), Braking, Steering & Suspension systems of the vehicle.

II. MATERIAL USED

The material used in the fabrication of this project is AISI 4130 steel . This steel provides the necessary strength. This metal is merged with both iron and carbon elements along with manganese, sulphur chromium, and silicon. Due to its versatile properties.
It is dominating in the current market. It is so useful that the American iron & steel industry and Society of Automotive Engineers (SAE) outlined numerous grades of steel that are made for specific purposes and denoted by 3 to 5-digit identifiers. 4130 is commonly used alloy steel.

A. Physical properties of AISI 4130

4130 steel is the standard name of the material.AISI stands for American Iron and Steel Institute, the first digit i.e. 4 of 4130 alloys indicates the class of steel. The second digit i.e. 1 represents the relative percentage of this alloying element and other important secondary elements present in the material and the remaining last two digits which is 30 represent the carbon concentration. By knowing these rules of 4130 steel, 4XXX & 41XX series (chromium-molybdenum steels)with around 1% molybdenum/chromium by mass with an included 0.30% carbon.
The chemical breakdown for AISI 4130 normalized steel at 870^0c is given below:

1) 0.28 - 0.33% Carbon
2) 0.7 - 0.9% Manganese
3) 0.8 - 1.1% Chromium
4) 0.15 - 0.25% Molybdenum
5) ≤ 0.04% Sulphur
6) 0.15 - 0.35% Silicon
7) ≤ 0.035% Phosphorus

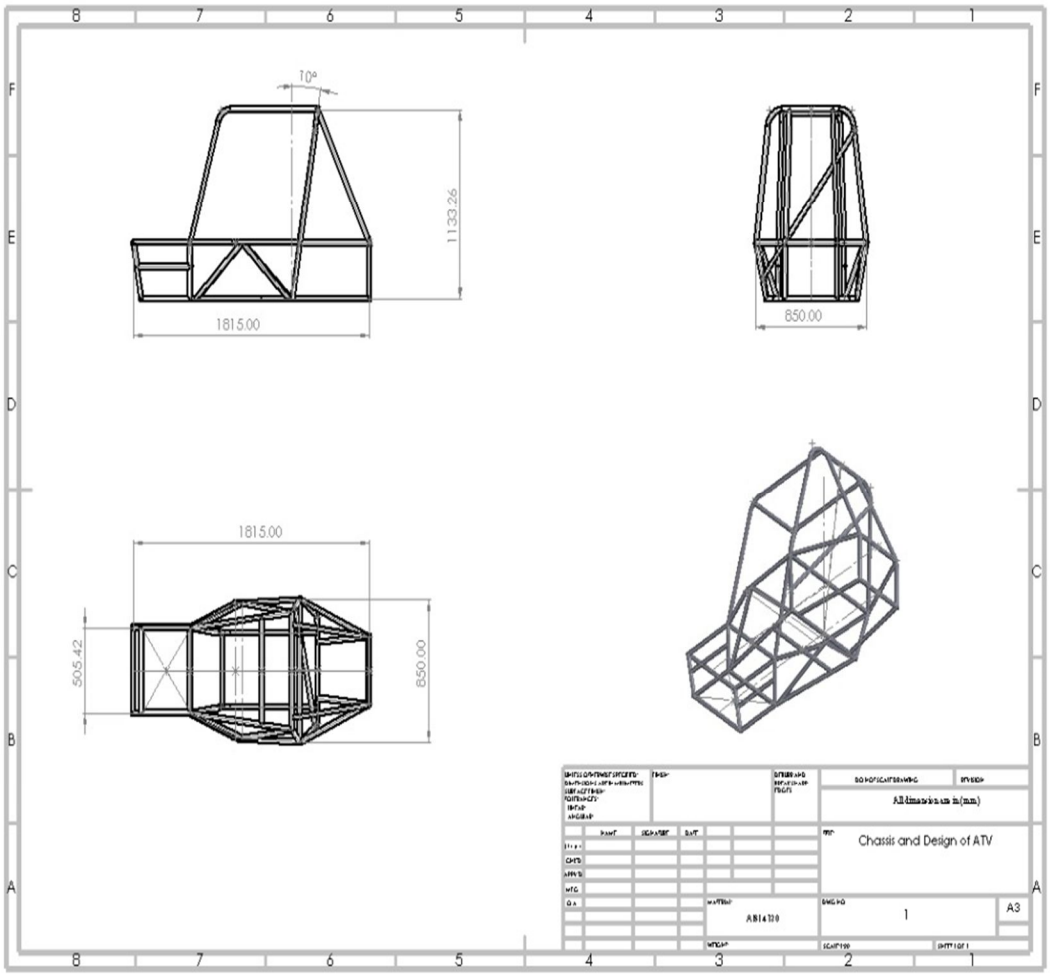
B. Mechanical Properties OF 4130 Steel Normalized AT 870^0c

Mechanical properties	Metric
Modulus of Elasticity	220 MPa
Ultimate tensile strength	731 MPa
Tensile yield strength	460 MPa
Rockwell B Hardness	92
Elongation of Break	25.5%

The elastic modulus is a measure of a material's elasticity, it is a common mechanical property which is used to show material stiffness.

C. Application of 4130 Steel

4130 alloy steel provides the necessary strength and durability to the structure to face various terrain. Due to the composition of this material which contains iron and carbon gives this material its versatile property.Considering these properties it is used for manufacturing equipment such as bearing,vehicle parts,crushing machinery and gears etc.the material backs up with good machinability and workability as its yeild strength and ultimate tensile stress is better as compared to other materials . As these properties are imparted by this material which makes it very useful.



III. CHASSIS AND DESIGN

The manufacturing of the structure of the chassis is done by using the AISI 4130 steel. Which has good weld-ability, ductility, and hardness. While making this chassis we used arc welding and MIG welding. Chassis is the main component in ATV which bears all the weight and provides suspension, so it should have good hardness and should not be compromised with flexibility. The simulation of chassis is practiced on Solid-works software. The weight of the chassis is 100kg.

IV. SOLID-WORKS FUNDAMENTALS

The Solid-Works application is mechanical design automation software that grasp's upper hand of the familiar Microsoft Windows graphical user interface. This easy-to-learn tool implement the possibility for mechanical designers to quickly sketch ideas, experiment accompanied by features and dimensions, and produce models and detailed drawings.

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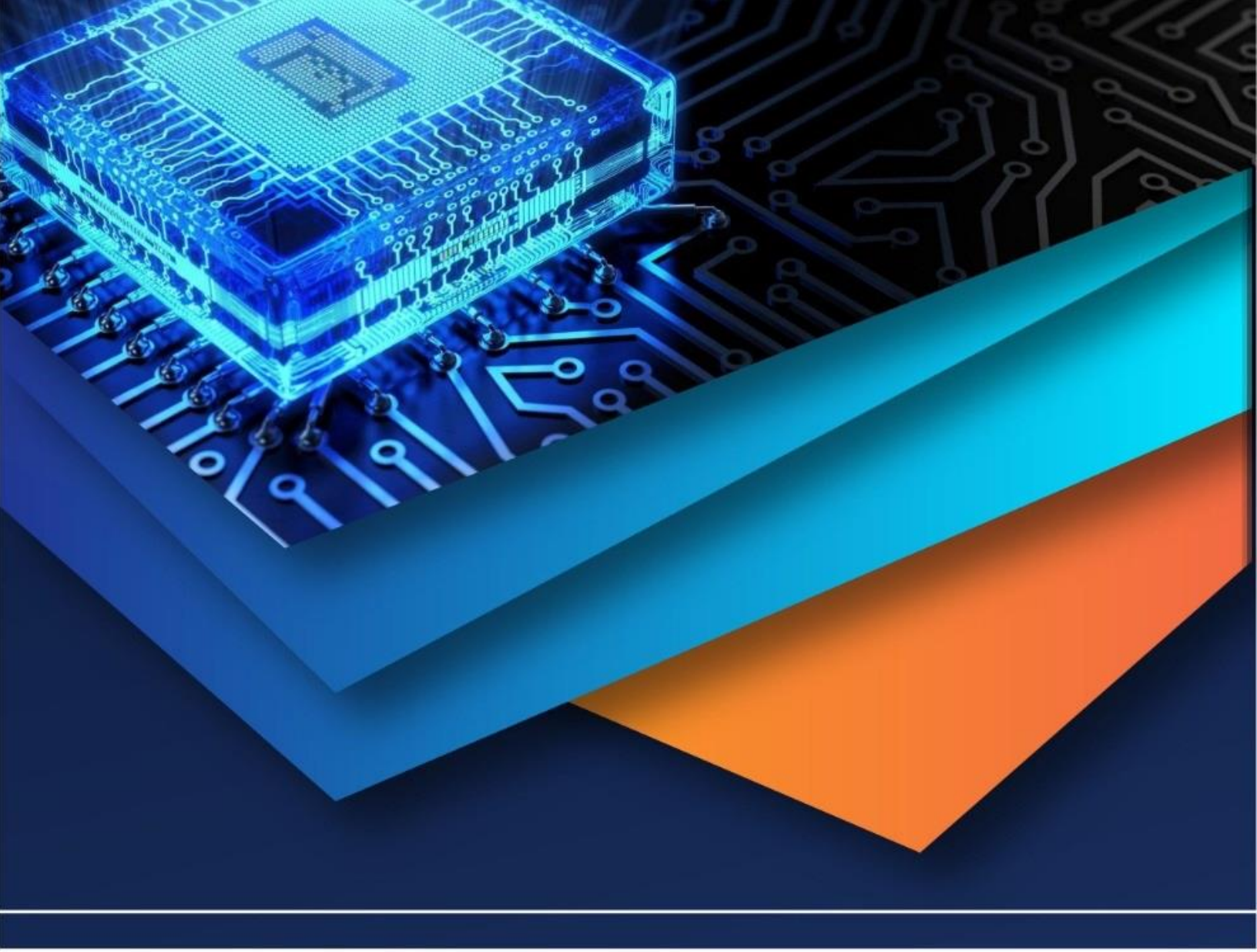
Fig1. plastic model of chassis



10.22214/IJRASET

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