ME209 PRINCIPLES OF MANUFACTURING PROCESSES

BALLS !!

INTRODUCTION

The objective of this project is to design and manufacture a ball that can bounce as high as possible when dropped from a height of 12 ft (1st floor). This project combines engineering, materials science, and 3D printing to make a ball that bounces really well when you drop it. We're aiming to create a ball that can absorb a lot of energy when it hits the ground and then use that energy to bounce back up really high.This report outlines the design considerations, manufacturing process, and testing procedures involved in achieving this goal.

DESIGN CONSIDERATIONS

The material we used for the 3D printing of the ball is PLA, which is chosen to demonstrate elasticity and high resilience to gain the maximize energy upon return.We have kept the internal core hollow so that the ball bounces well as it has less weight.The fitting of the two halves of the balls is done by making threading in them so that they fit well with each other and do not break when dropped or fall apart if done with just by applying adhesives on the thickness of the two halves. We even have some rough surfaces on the ball so that there is maximum return.

CHOICE OF PROCESS PARAMETERS

The choice of process parameters in 3D printing is crucial for achieving desired outcomes. **PLA** (Polylactic Acid) is often the material of choice due to its favorable characteristics for bouncing ball fabrication. PLA's stiffness and elasticity make it well-suited for producing objects with resilient properties, like bouncing balls. Moreover, PLA is known for its ease of printing, offering stable performance on a variety of 3D printers. One of the ball had a diameter of 40 mm and a thickness of 2 mm with threading of size 8 and thickness of 1 mm. The other ball is of diameter 35 mm with 1.5 mm thickness and threading of size 1.6 and thickness having 0.5 mm.The Threading part of the ball Just acted like a support to the Balls, thus in act of removing the supports from the ball the threading part was also removed.

PROCESS

- The process began by creating CAD models of two hollow spherical shells with varying thicknesses and diameters.
- These models were designed for comparison to determine which bounces more effectively.
- Following the CAD design, STL files were saved and transferred to a Tinkerer’s Lab for 3D printing.
- Utilizing a Creality K1 Max printer, the models were printed with precision.
- Once printed, the two balls were examined and compared to assess their bouncing capabilities.

- This method allowed for a systematic evaluation of how thickness and diameter impact the bouncing performance of the shells.

LEARNING FROM THE OUTCOME

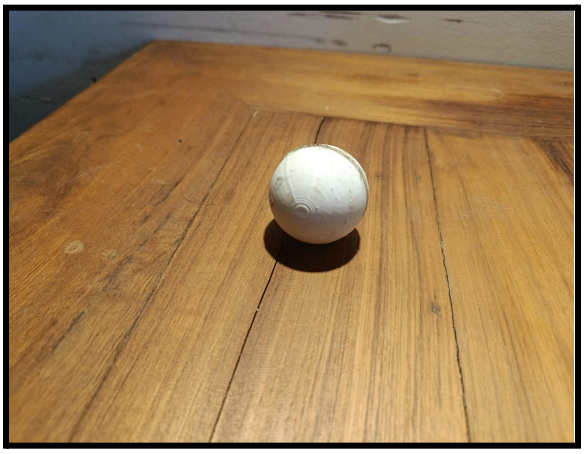
There are several learning outcomes which we came across during the whole process.

- We have learned the step-by-step process of reproducing any piece of art onto a Ti6Al4V sample using laser etching technology. This includes understanding the setup, calibration, and execution of the laser etching process to achieve accurate replication of artwork.
- We could understand what materials can be used for high performance of the ball and other subjects, how we can make it more efficient in terms of design and manufacturing.
- Through drop testing and impact analysis, the project evaluates the effects of kinetic energy transfer on the ball and insights on the impact forces and deformation characteristics of a given material.
- Engaging in additive manufacturing and testing procedures offers practical, hands-on experience that reinforces theoretical knowledge and enhances technical skills.

REFERENCES

[1] M. (2014, May 8). *What Is 3D Printing and How Does It Work? | Mashable Explains*. YouTube.https://www.youtube.com/watch?v=Vx0Z6LplaMU

PHOTOS OF THE CHALLENGE DONE



PEER REVIEW GRADES

NAME	ROLL.NO	MARKS
Ashmit Chokker.	22110040	7
Deepak Soni	22110068	10
Kethavath Shivaprakash	22110120	7
Trivedi Vatsal	22110276	8

Vidhi Shah	22110286	9
Viraj Vekaria	22110287	7