



Shell Eco-marathon

CARBON FOOTPRINT AWARD
TEAM UMAKIT - TURKEY

For the production of carbon fiber models in the industry, chemicals, gases and fibers that are harmful to nature are used in molding. With these production methods, greenhouse gas formation and the release of insoluble substances into the environment occur. Natural PVA, which will be used as a molding material in our project, is a natural material that can be easily dissolved in nature. No other environmentally harmful chemicals or gases are used in this molding method.



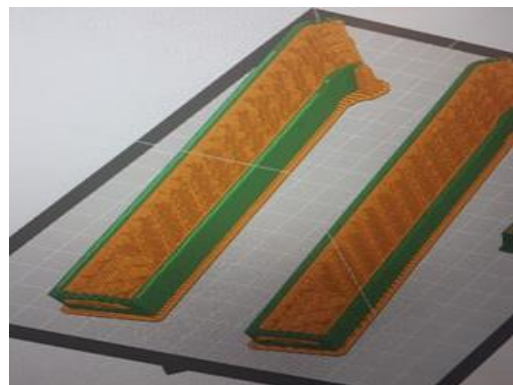
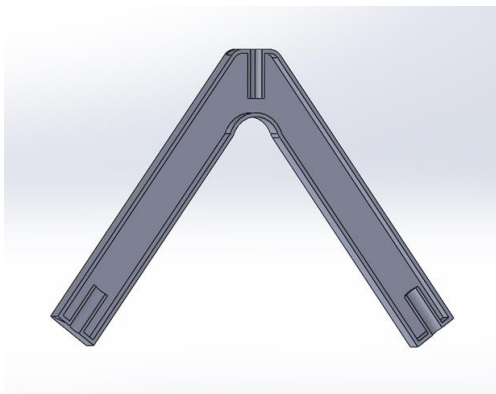
1.8. Used in industrial molding harmful chemical materials 1.9. The water soluble pva filament we use

In the production of carbon fiber swing arm, two female molds are produced and the two parts of the model are subsequently combined to form the model. A decrease in strength was observed in this method. This decrease in strength is prevented by producing a model in a single piece with a male natural PVA mold.

In the production of carbon fiber models, freedom and originality in design are limited due to molding. Topology optimizations are provided in designs with the ease of PVA mold dissolving in water. This provides weight gain in the model. Plus, carbon usage is reduced by manufacturing parts with the same strength with less material.

Production Stages of Our Innovation:

First, a female mold model was created from a PLA material for natural PVA using our aluminum swingarm design.



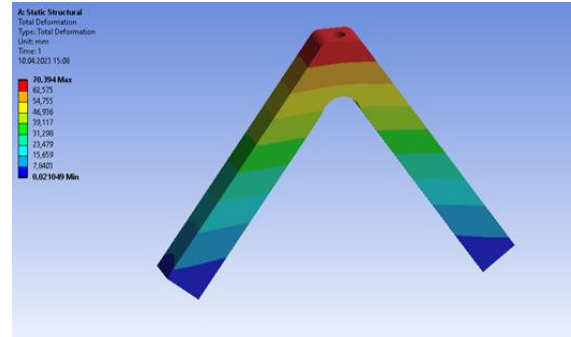
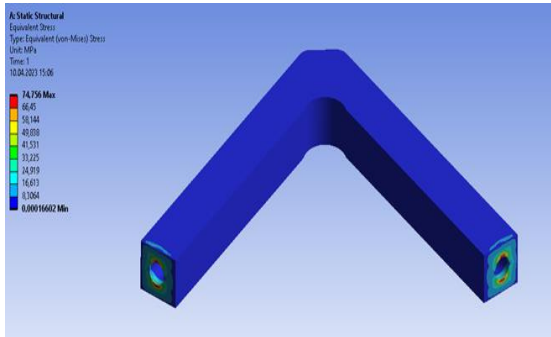
1.10. Swing Arm Mold 1.11. Swing Arm Printer Preview

We obtained the natural PVA print of these mold models in cooperation with the Coşkunöz Education Foundation company. Since we could not print natural PVA filament from the main nozzle, we solved this problem by printing outer PLA material and natural PVA filament as a support structure to the hollow structure of the model. Since the mold did not fit on the printer table, we produced it by dividing it into two, and then we combined it into a single mold.



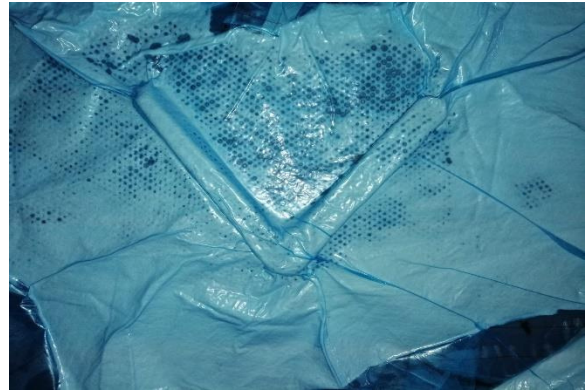
1.12. Our pattern outputs taken from the printer 1.13. Parts Assembly

Afterwards, we modeled the carbon fiber swingarm to come out of the mold and applied structural analysis. As a result of the analysis, we observed that the swing arm was usable by looking at the stress and deformation values. We determined the amount of carbon fiber usage areas according to the stress distributions and performed topology optimization studies.



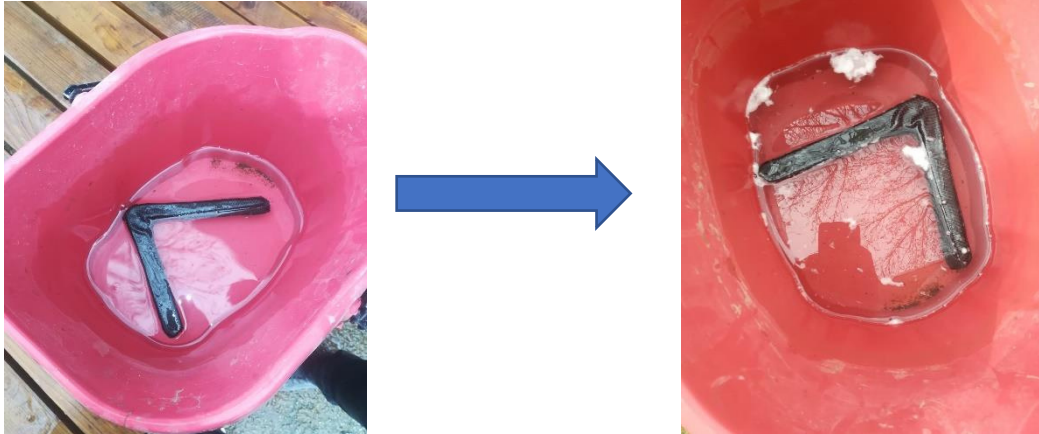
1.14. Swing Arm Loads and Analysis

We created our carbon fiber model on the mold by laying carbon fiber on our mold by hand.



1.15. Fiber depositing processes with our molds produced

We have ensured the dissolution of the PVA material by immersing the object in which the mold and the product are unique.



1.16. Immersion of the mold made of PVA material and fabric wrapped around it for the final product.



1.17. Placing the produced Swing arms on the vehicle

In conclusion, We produced the front upper wishbones of our vehicle thanks to the molds we developed and produced. We managed to reduce our carbon emission values by not using toxic and dangerous products such as glass fiber, resin, gelcoat and mekp used in molding methods. We aim to transform our vehicle into a system that is produced with completely zero waste products, with the products to be obtained by disseminating this method in vehicles.