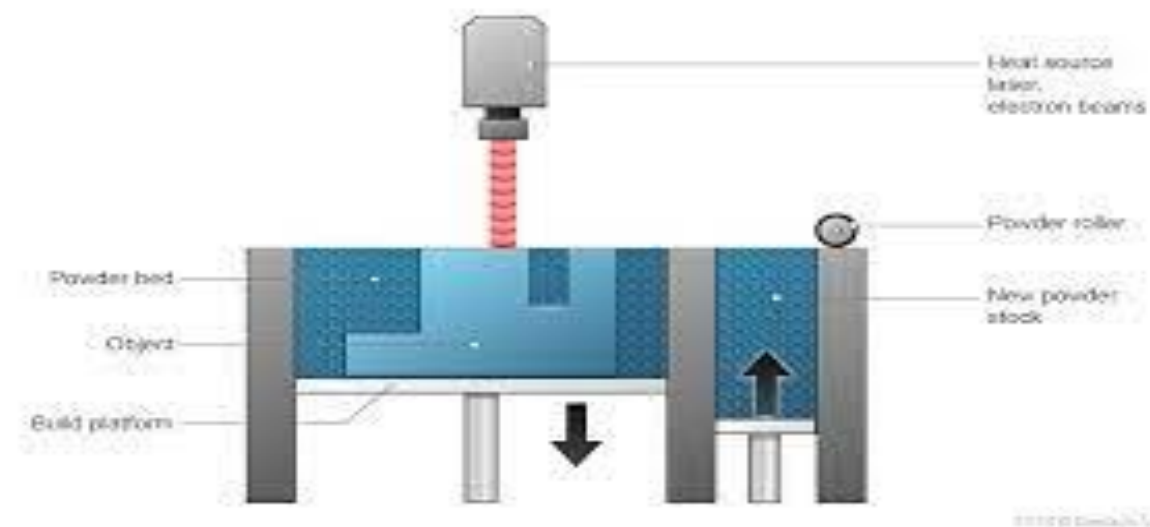




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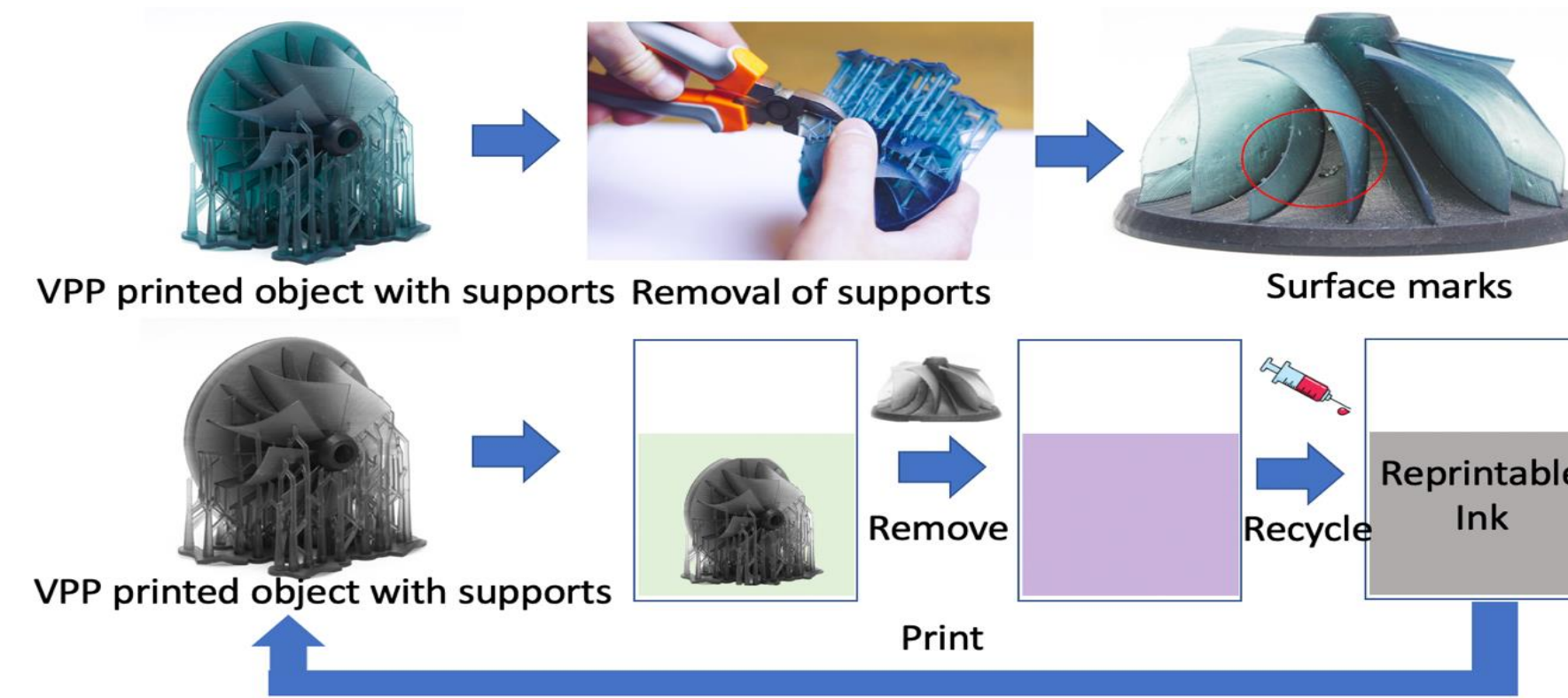
## Introduction

Materials that are highly recyclable and removable used for 3D printing are made by using the novel process of VPP (Vat Photopolymerization) Current vat photopolymerization (VPP) technology can print three-dimensional (3D) objects with high precision and fast speed. For complex computer-aided design (CAD) mega-structures, a significant amount of additional support structures is required in order to ensure the overhanging and free-hanging features can be fabricated. Hence VPP process is beneficial in fabricating these smart- structures.



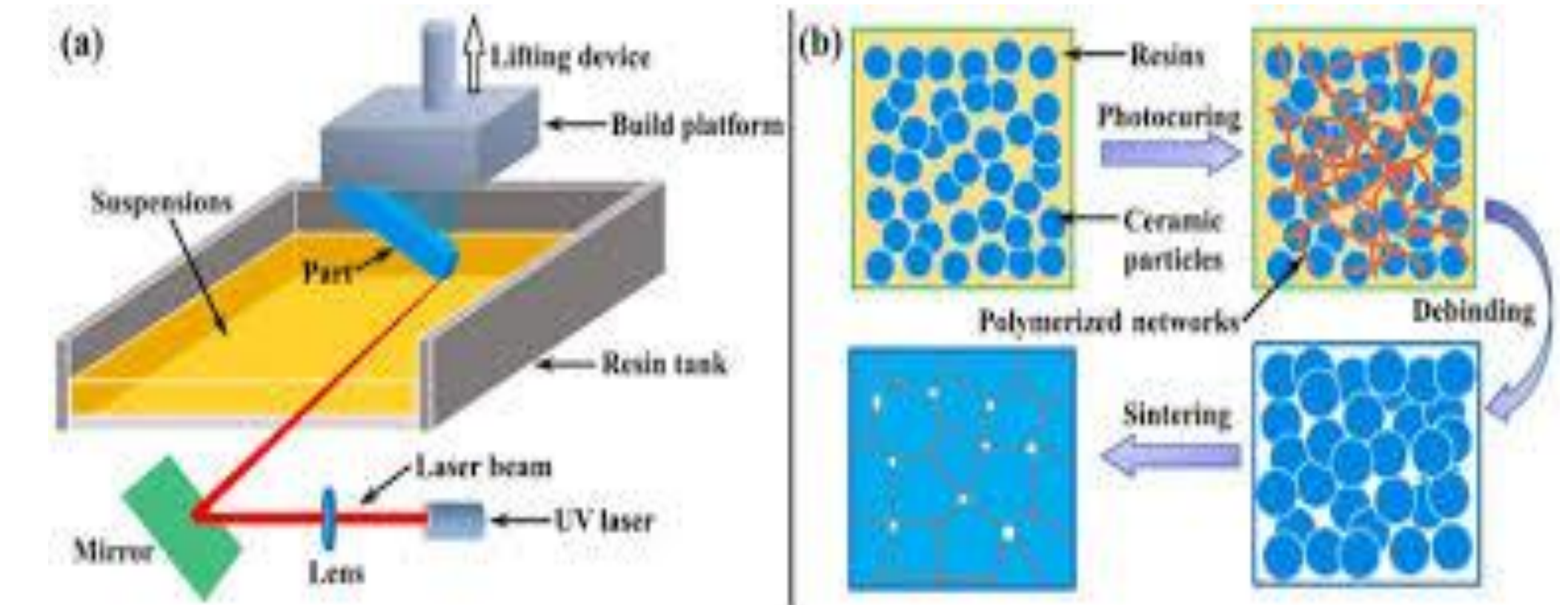
## VPP Process

- Vat polymerization uses a vat of liquid photopolymer resin, out of which the model is constructed layer by layer. An ultraviolet (UV) light is used to cure or harden the resin where required, whilst a platform moves the object being made downwards after each new layer is cured.
- As the process uses liquid to form objects, there is no structural support from the material during the build phase.
- Resins are cured using a process of photo polymerization or UV light, where the light is directed across the surface of the resin with the use of motor controlled mirrors



## Polymerization Step-by-step

- 1) The build platform is lowered from the top of the resin vat downwards by the layer thickness.
- 2) A UV light cures the resin layer by layer. The platform continues to move downwards, and additional layers are built on top of the previous.
- 3) Some machines use a blade which moves between layers in order to provide a smooth resin base to build the next layer on.
- 4) After completion, the vat is drained of resin and the object removed.



## Future work

Investigate a proper chemical for making the printed models which are highly recyclable and removable  
To further test the physical and chemical properties of the printed material

## Acknowledgement

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Yang, Y., Song, X., Li, X., Chen, Z., Zhou, C., Zhou, Q. and Chen, Y., 2018. Recent progress in biomimetic additive manufacturing technology: From materials to functional structures. *Advanced Materials*, 30(36), p.1706539.

## Abstract

Current vat photopolymerization (VPP) technology can print three-dimensional (3D) objects with high precision and fast speed. For complex computer-aided design (CAD) mega-structures, a significant amount of additional support structures is required in order to ensure the overhanging and free-hanging features can be fabricated. However, internal support structures cannot be directly removed, and it is time-consuming to manually remove all the support structures. In addition, unexpected damage and undesired surface marks will be caused by the removal of the support structures. In this research, a novel vat photopolymerization process is developed and smart meta structures using highly removable and recyclable polymer as supports will be fabricated. Research tasks including hardware construction, material preparation, and system control are conducted.