

Synthesis and characterization of Photo-curable Polyurethane-Acrylate for 3D Printing based on Viscosity and UV Curing time

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Abstract

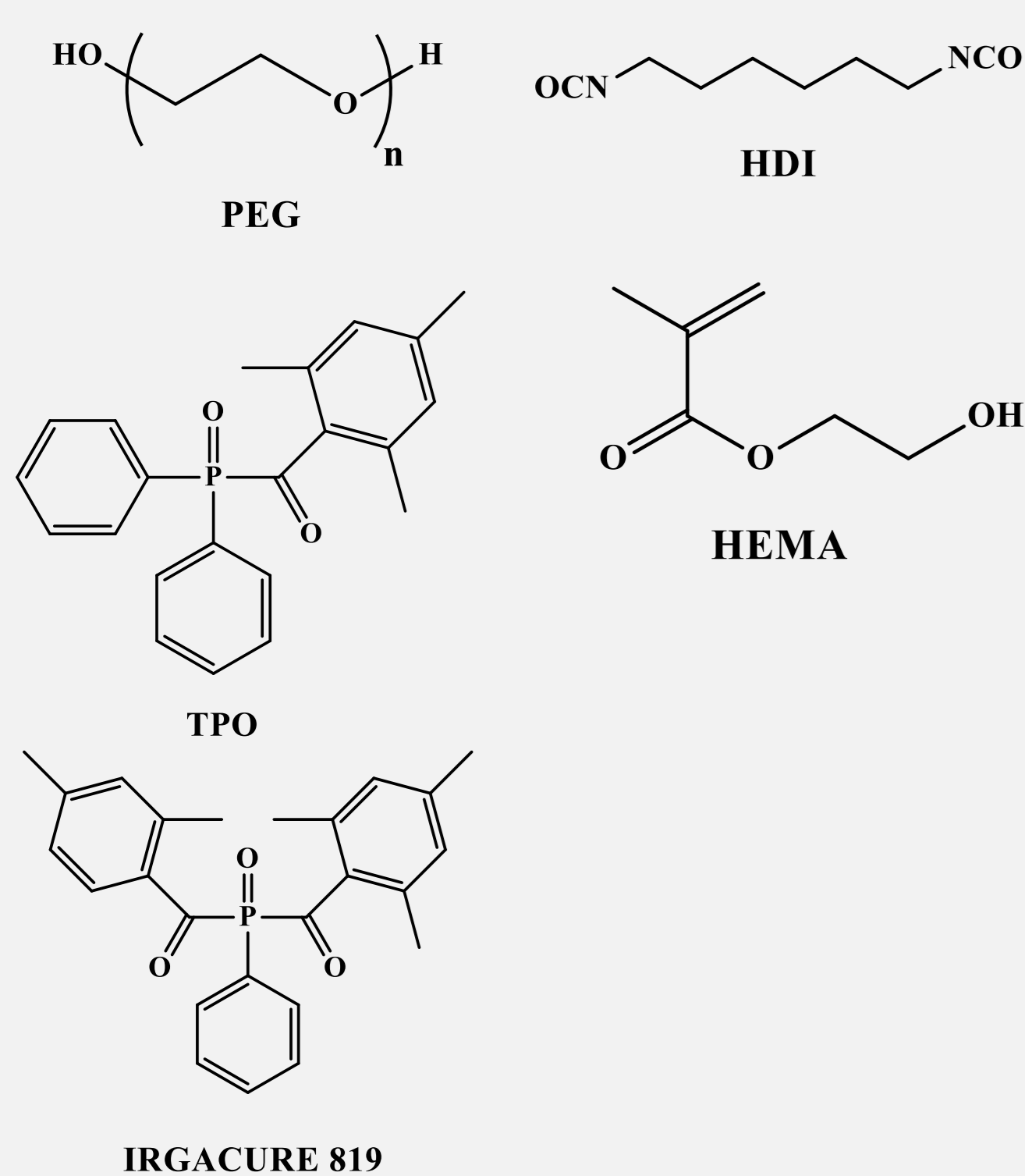
A UV curable acryl-polyurethane is successfully prepared by a combination of polyethylene glycol (PEG) as polyols, hexamethylene diisocyanate (HDI) as an isocyanate, hydroxyethyl-methacrylate (HEMA) as multifunctional acrylate and diphenyl(2,4,6-trimethyl-benzoyl)phosphine oxide (TPO) was used to photo initiator. The crosslinking step of acryl-polyurethane elastomers were processed using 385~405nm radiation for DLP 3D printing by controlling the viscosity and UV curing time. The functional group of the resulting acryl-polyurethane was evaluated by fourier transform infrared spectroscopy (FT-IR). The molecular weight was evaluated by gel chromatography (GPC). The mechanical properties such as tensile strength, elongation, modulus and flexural strength were evaluated by universal testing machine(UTM). The viscosity was evaluated by viscometer. The surface resolution-quality of the 3D structure was analyzed by field emission scanning electron microscope (FESEM).

Objective

- To synthesize the PU-Acrylate product with PU and Acrylate
- To evaluate the curing time effect on the mechanical properties of PU-Acrylate
- To compare the viscosity of PU-Acrylate blend

Experimental

Materials

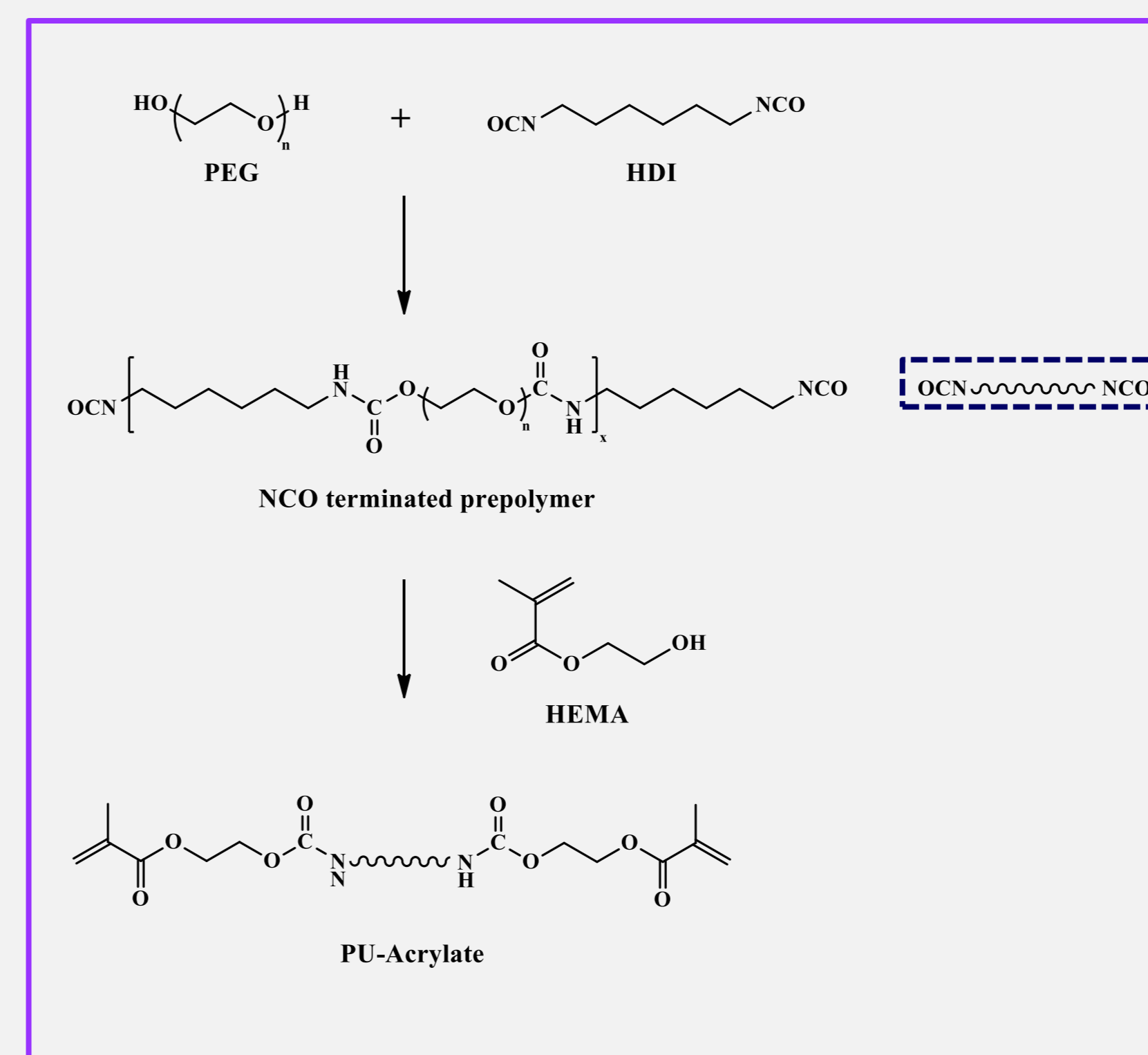


DLP 3D printer

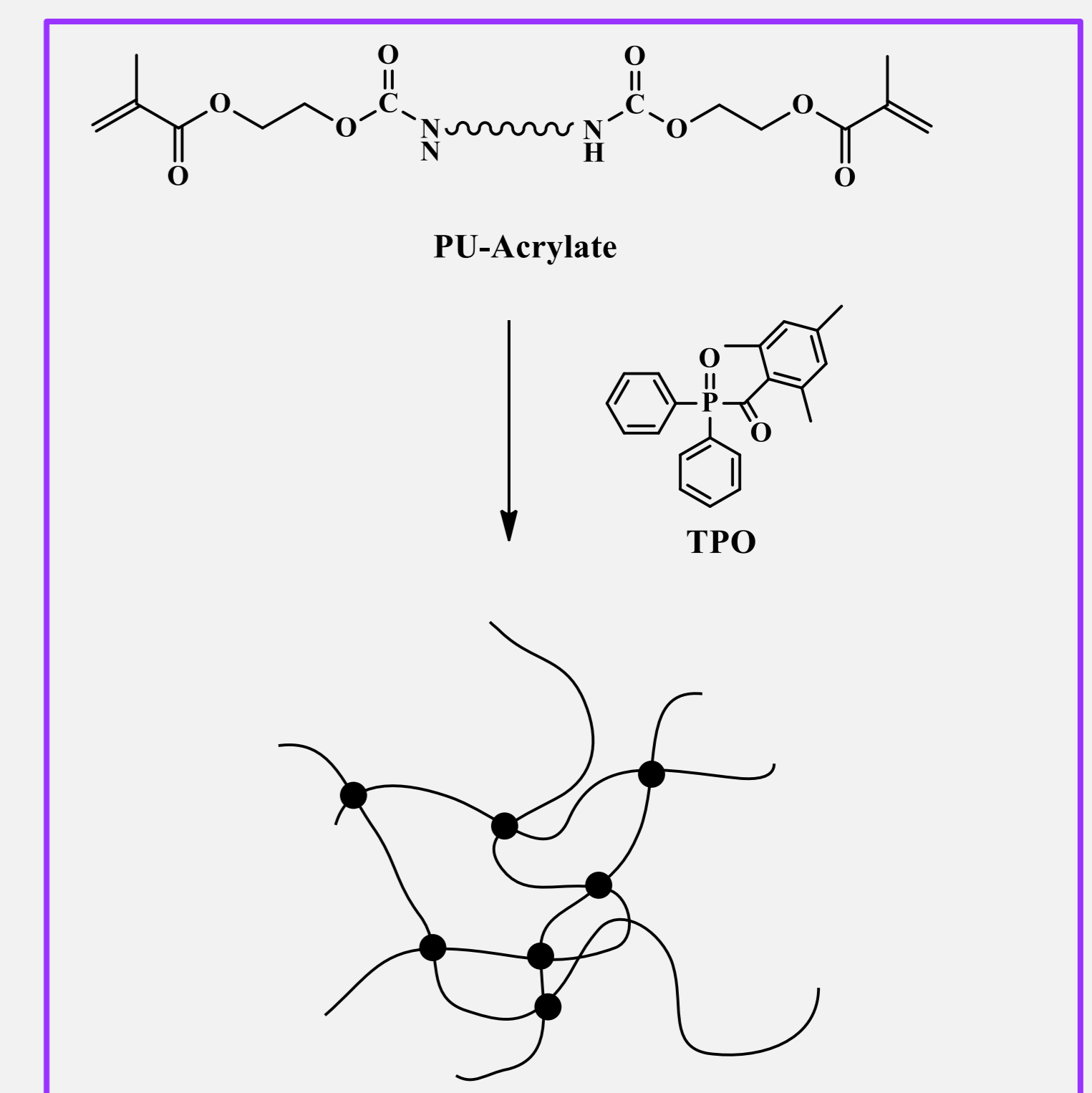


1. Used by Carima DLP 3D printer
2. Printed it out by controlling the curing time

Scheme 1



Scheme 2

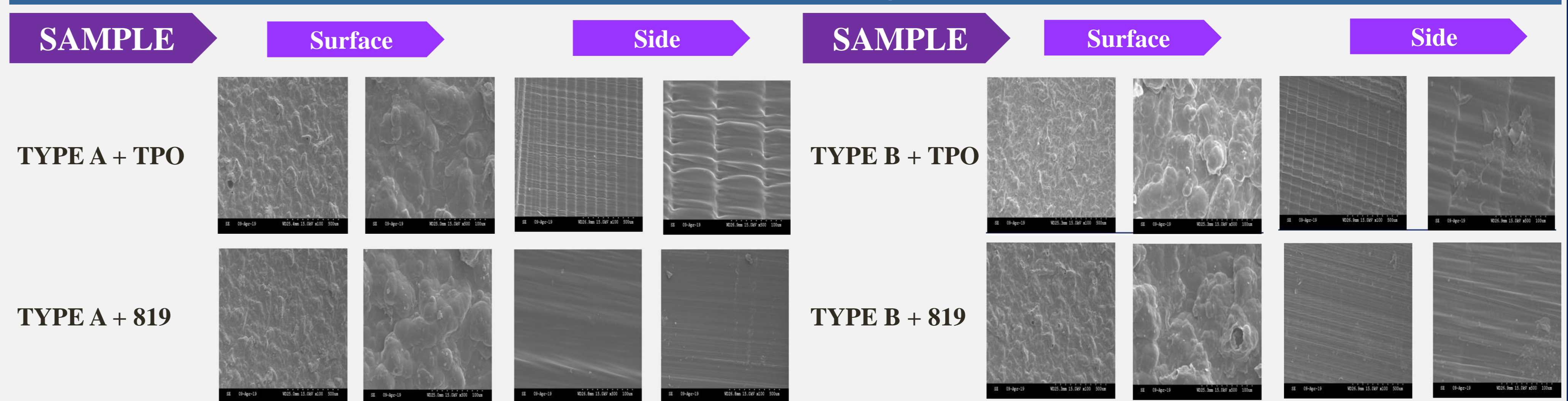


Results

VISCOSITY

SAMPLE	VISCOSITY	CONDITION	
		SHEAR RATE	DURATION
Blend TYPE A + TPO	27595 cps	50s ⁻¹	60sec
Blend TYPE A + 819	28626 cps		
Blend TYPE B + TPO	30082 cps		
Blend TYPE B + 819	28411 cps		

FE-SEM image



Conclusion

- The successful synthesis PU-Acrylate and UV-cured by photo-initiator
- Side lamination was better when TPO initiator was used.

Acknowledgement

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