International Conference on Advanced Chemistry and Catalysis
Advanced Chemistry and Catalysis Engineering
December 06 - 07, 2018 | Las Vegas, Nevada, USA

Fabrication of Photo-curable Polyurethane through Short Curing Time

Hyo Jin Jung, Ji-Hong Bae, Kyung Seok Kang, Chan Hyuk Jee, Wonbin Lim, Byung Joo Kim, PilHo Huh
Department of Polymer Science and Engineering, Pusan National University, Busan 609-735, South Korea
**** pilho.huh@pusan.ac.kr***

Abstract

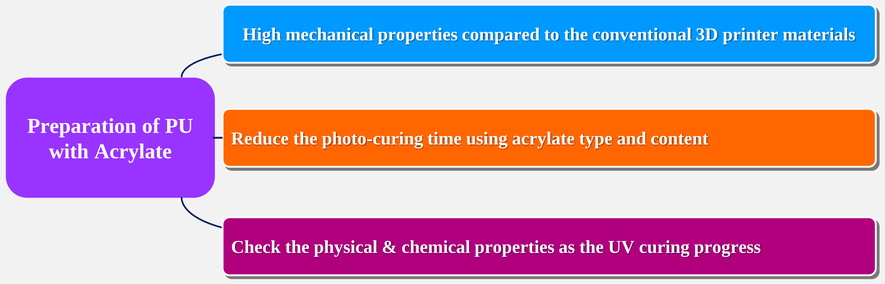
Photo-curable Polyurethane was successfully synthesized by the additional reaction of methylene diphenyl diisocyanate (MDI), poly(tetramethylene ether) glycol 1000, and tri-acrylate derivatives as a crosslinking point. Synthesis of Polyurethane was confirmed by fourier transform infrared spectroscopy (FT-IR), gel permeation chromatography (GPC). The photoinitiator used the benzophenone. The crosslinked PU-acrylate elastomers were fabricated by the exposure to 200~400μm UV radiation. DMF was used as a solvent for the synthesis, but THF with low UV cut off was used to crosslinked the acyrl-polyurehane in order to reduce crosslinking time. The mechanical, thermal and optical properties of the polyurethane film before curing and the cured film were compared. All physical properties were confirmed by universal testing machine (UTM), ultra violet spectroscopy (UV-Vis) and differential scanning calorimetry (DSC). Tensile strength was measured from 8.2 to 15.9MPa. The short photo curing time and mechanical strength confirmed the applicability as a 3D printing material.

Objective

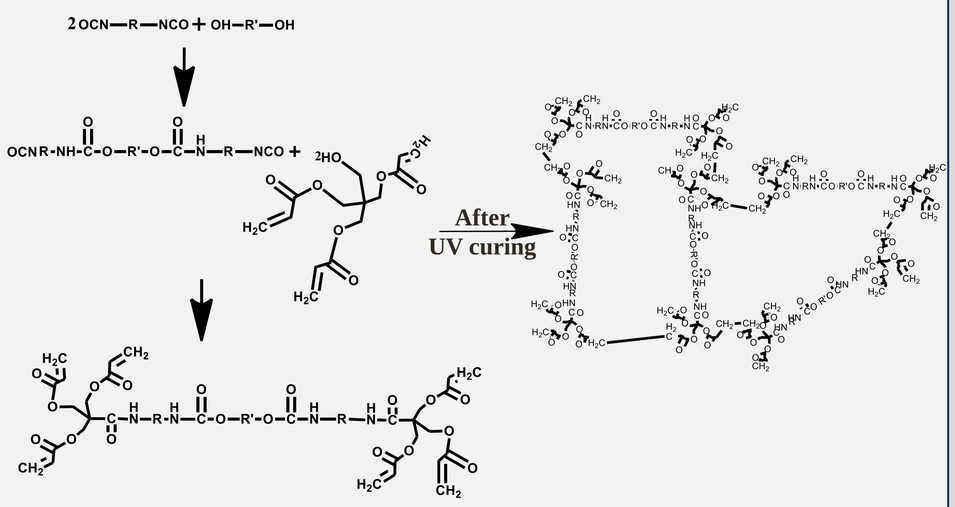
1. To synthesize a PU-acrylate series composed of PTMG as a polyol, MDI as an isocyanate and acrylate

2. To evaluate the physical properties and reduce the photo-curing time of PU-acrylate

3. To compare the film as the UV curing progress



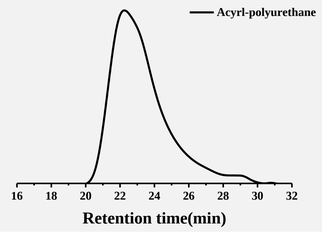
Experimental



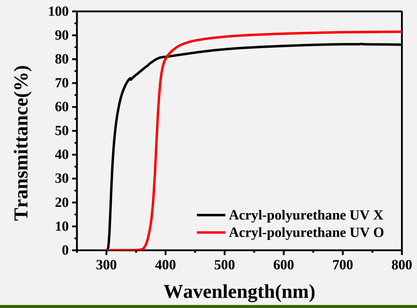
Results

GPC

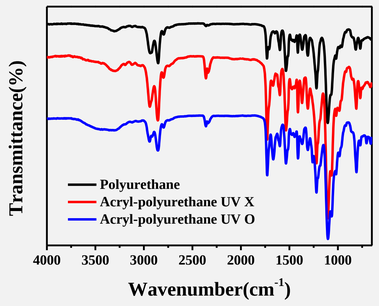
	M_n	M_w	PDI
Acryl-polyurethane	10200	27320	2.68

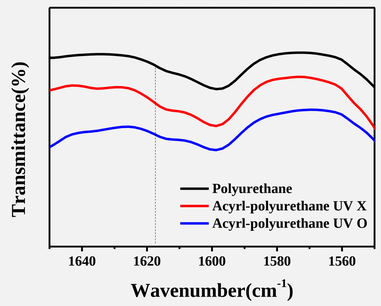


UV Transmittance

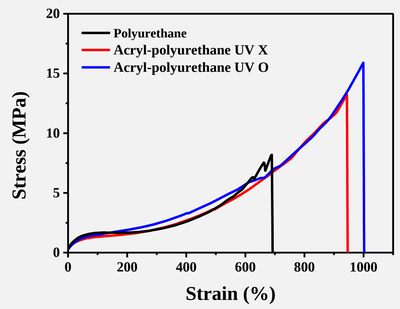


FT-IR



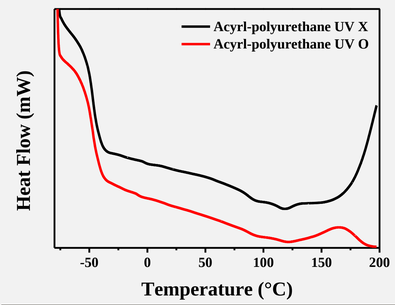


UTM



	Percent strain (%)	Tensile strength (MPa)
Polyurethane	690	8.2
Acryl-polyurethane UV X	950	13.2
Acryl-polyurethane UV O	1000	15.9

DSC



	Tg	Tm	ΔH_m(J/g)
Acryl-polyurethane UV X	-46°C	118°C	1.716
Acryl-polyurethane UV O	-48°C	121°C	1.101

Conclusion

- The successful synthesis Acryl-polyurethane and UV-cured by the photo-initiator
- Reduce of functional peak C=C double bond after UV-curing
- The special optical properties of the Acryl-polyurethane after UV-curing (UV transmittance : 84 to 90%)
- The increase of percentage strain and tensile strength after UV-curing
- The decrease of ΔH_m value because as the UV curing proceeds, the crystallinity of PU decreases due to the increasing amorphous part.
- To demonstrate potential applications of 3D printer materials

Acknowledgement

This work was supported by the Basic Science Research Program of the National Research Foundation of Korea(2015R1D1A1A09057372). The authors are also grateful to the BK21 PLUS Program for partial financial support