

Synthesis of Self-healing Polymer based on Slide-ring Polyrotaxane of Polyurethane and Cyclodextrin

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

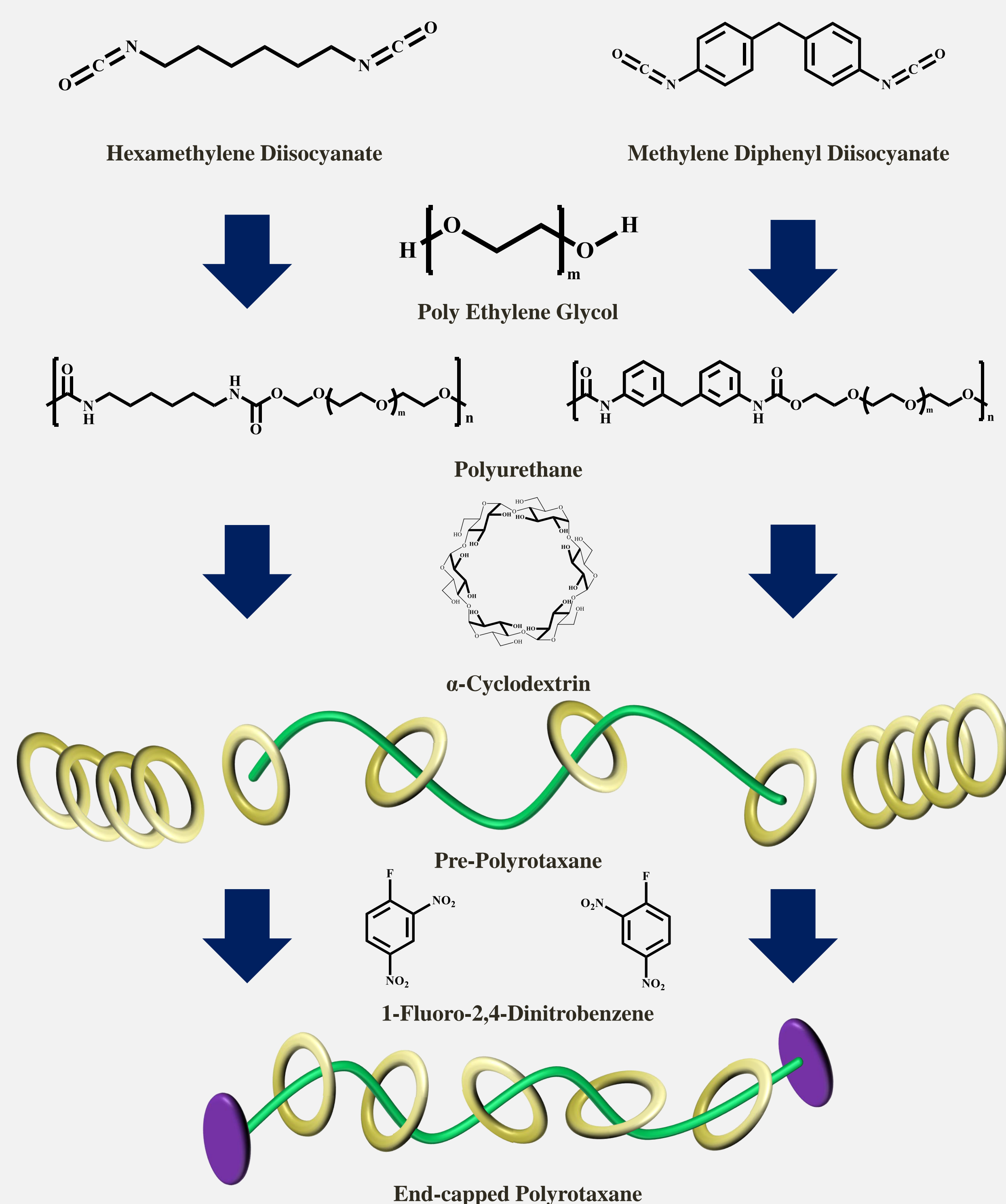
Abstract

Poly(Ethylene-glycol) (PEG)- α -cyclodextrin (α CD) polyrotaxane (PR) was fabricated by the spontaneous reaction of an internal architecture between PEG as long stick and α CD as cyclic ring in water solution. Self-healing polyurethane (PU) was prepared from PEG/ α CD PR and isocyanate. End-capping reagent of PR is 1-Fluoro-2,4-Dinitrobenzene. The synthesis and characterizations of PEG/ α CD PR-PU was analyzed by ^1H nuclear magnetic resonance (^1H -NMR) and differential scanning calorimetry (DSC). Due to self-healing properties of the PR and the mechanical properties of the PU, it will be applied to self-healable coating and abrasion resistance materials.

Objective

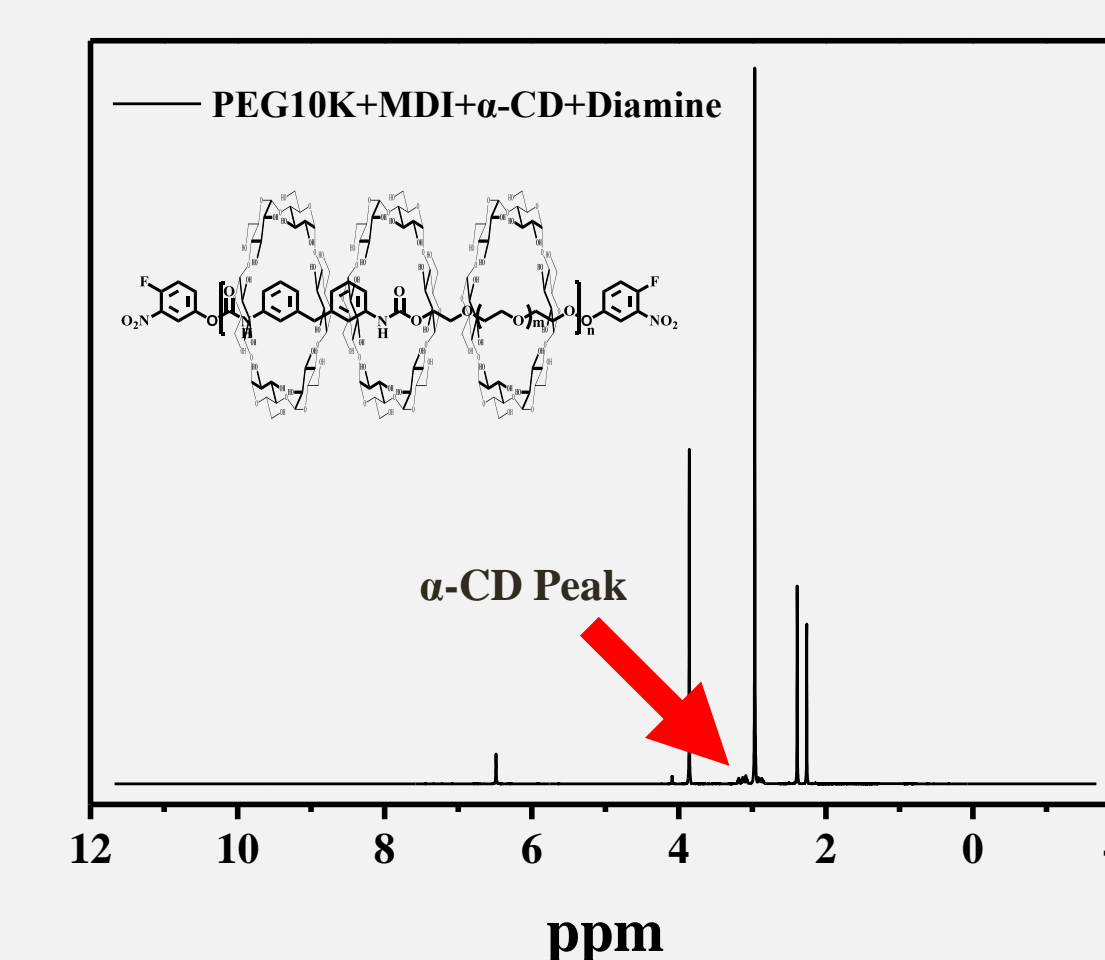
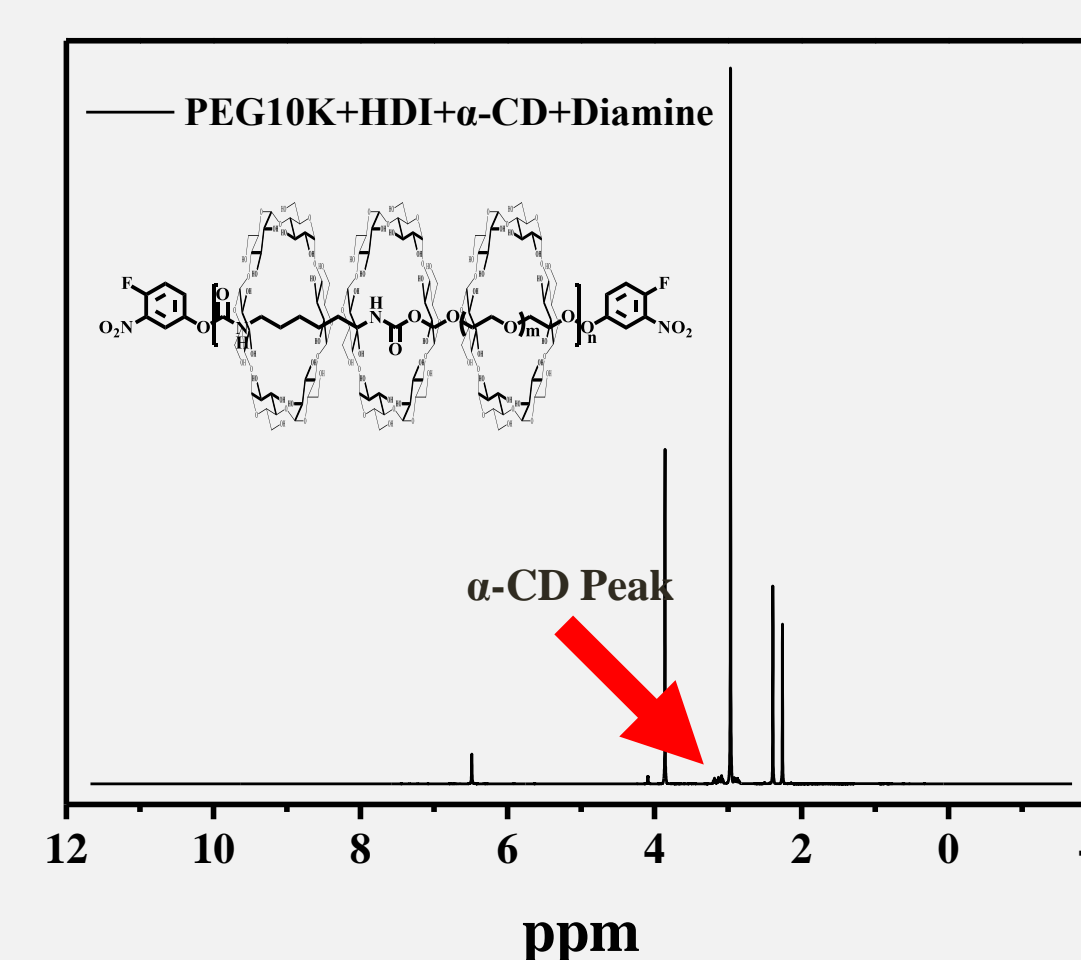
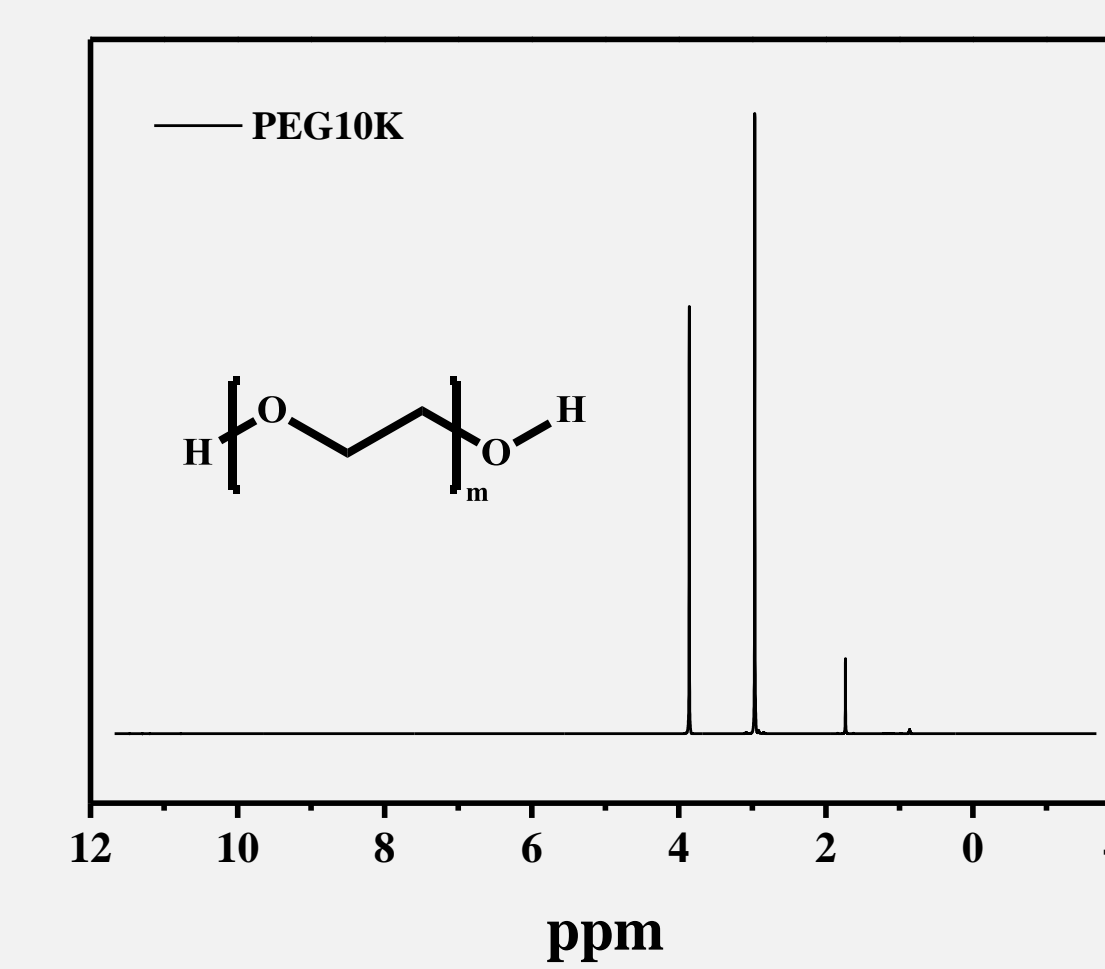
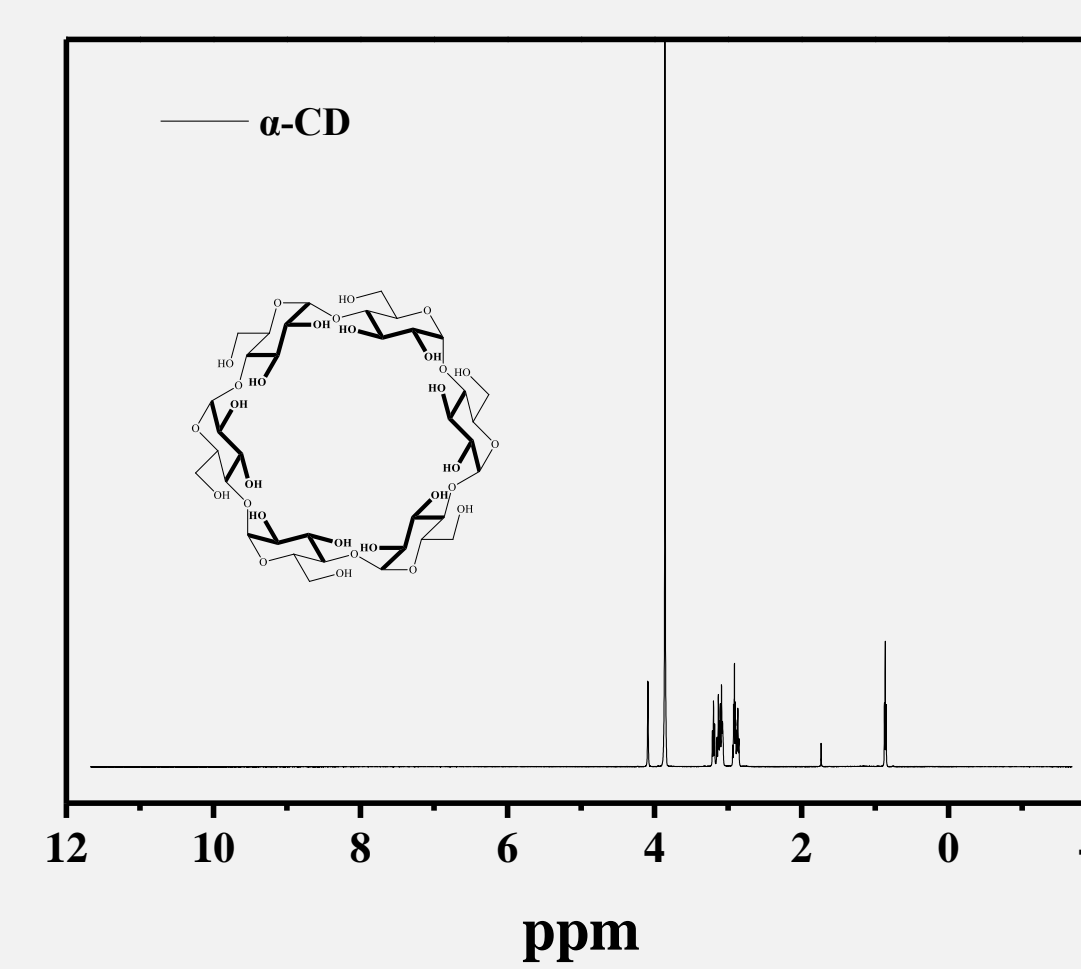
1. To synthesize a Polyrotaxane structure composed of PU as long stick and α CD as cyclic ring
2. To analyze the synthesis was successful and estimate thermal properties to find optimum self-healing temperature

Experimental

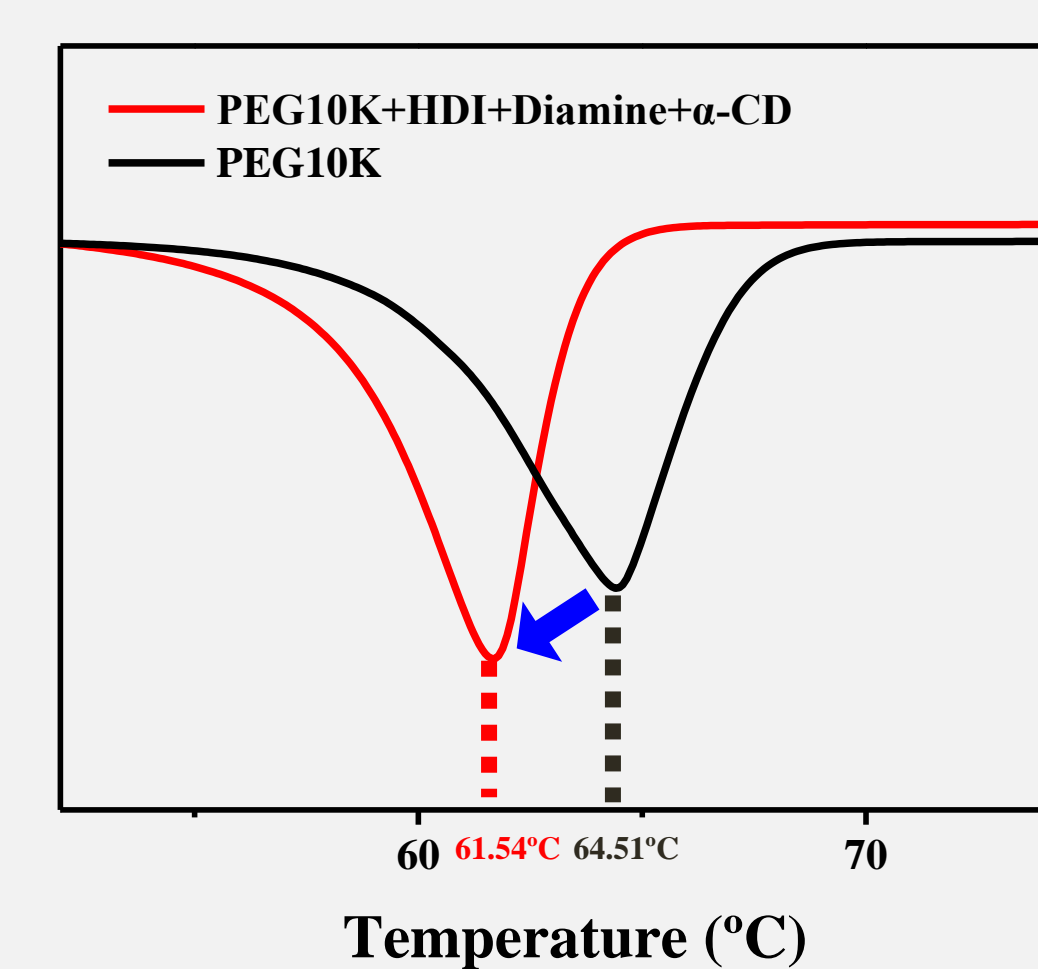


Results

500MHz ^1H NMR

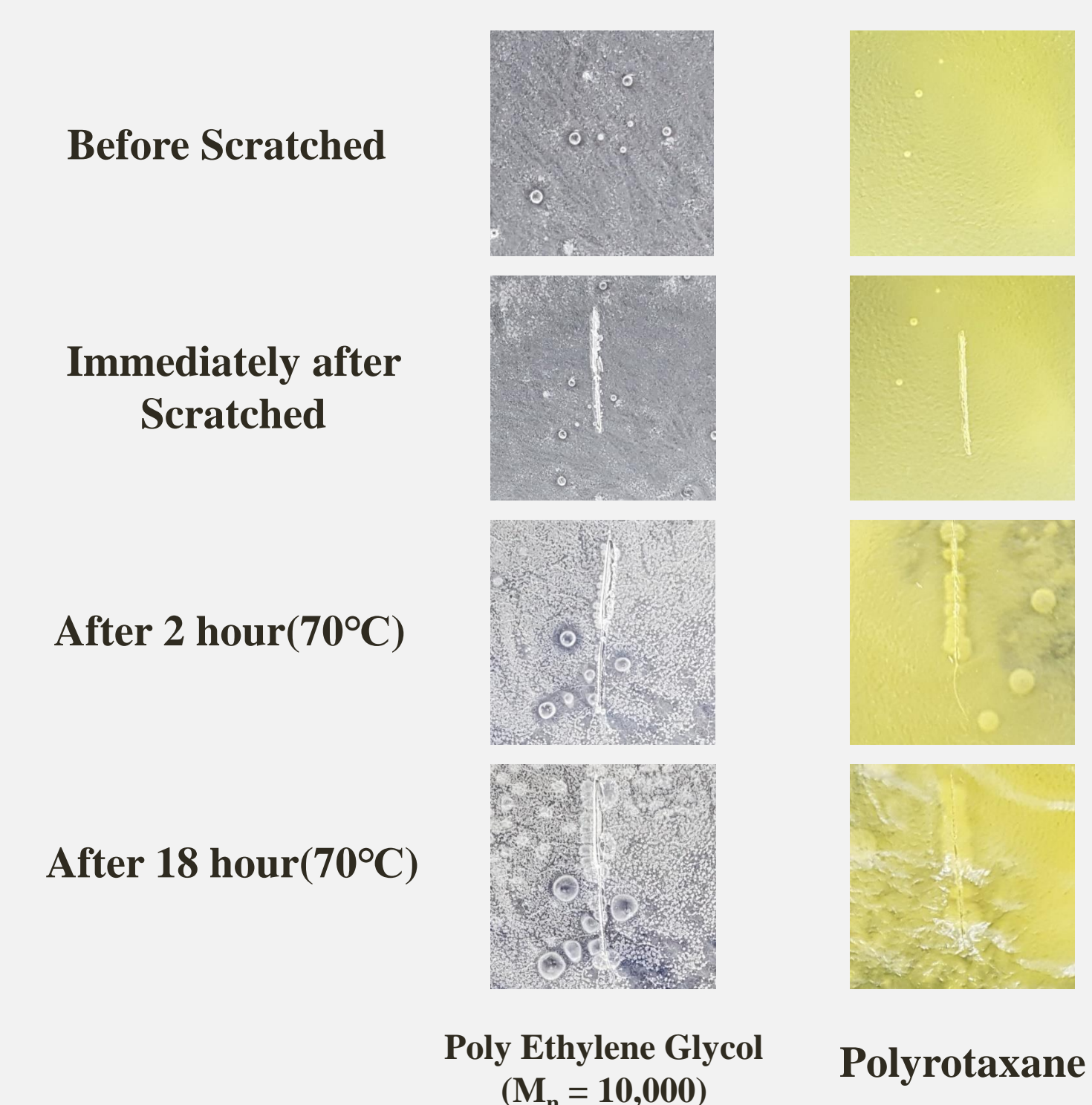


DSC



Material	Melting Temperature (°C)
PEG10K	64.507
PEG10K+HDI+Diamine+ α CD	61.539

Self-Healing Image



Conclusion

- Successful synthesis of PEG/ α CD PR-PU shown by ^1H NMR analysis
- Self healable of PR due to the lower melting temperature
(T_m : 64.51°C \rightarrow 61.54°C)
- To prove potential applications of abrasion resistance coatings

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.