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Synthesis of UV-responsive polymers for adhesion application

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1. Introduction

Synthetic method used in the work:
Initiated Chemical Vapor Deposition (iCVD)

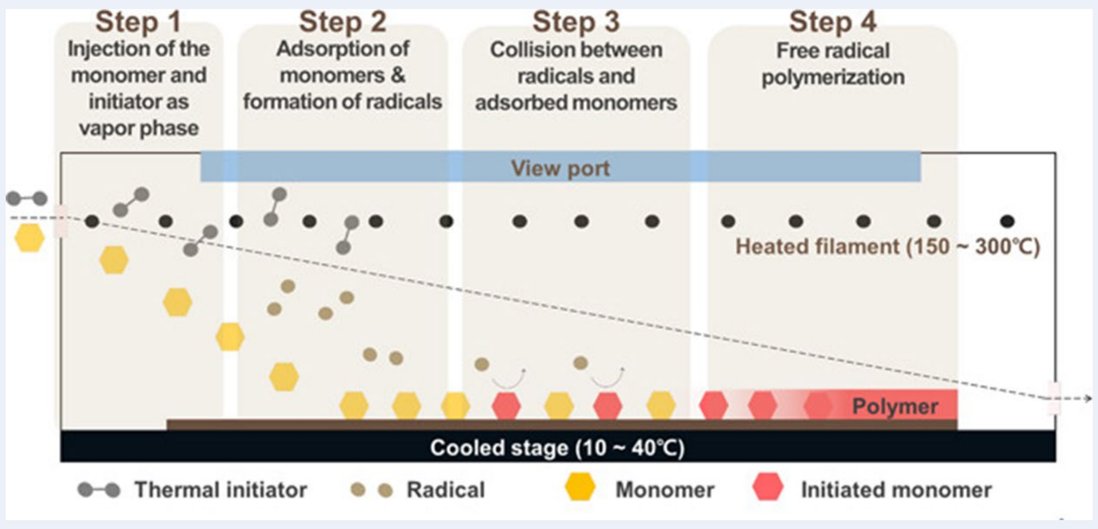


Figure 1. Scheme of the iCVD process in the deposition reactor.[1]

High quality | **Solvent-free** | **Low energy inputs** | **Conformal coverage**

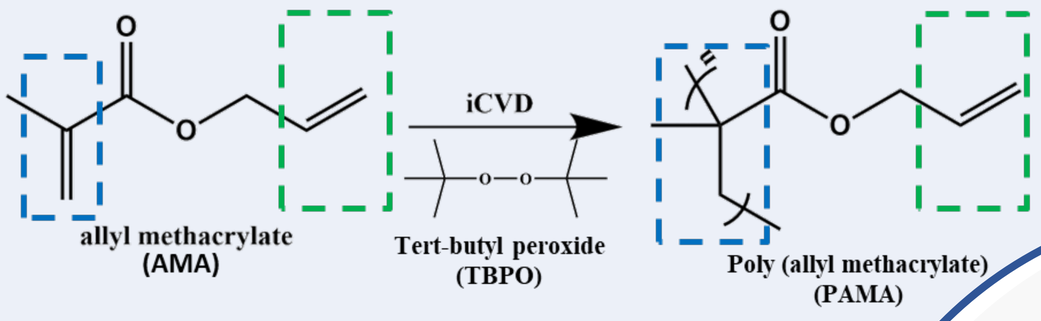


Figure 2. Chemical structure of the monomer and initiator used in the iCVD process.

1. Adv. Eng. Mater. **2018**, 20, 1700622

2. iCVD of Poly (allyl methacrylate)

Table 1. iCVD deposition conditions

Flow rate (sccm) AMA	TBPO	Pressure (mTorr)	Stage Temperature (T_s) (℃)	Filament Temperature (T_f)(℃)
1.4	0.6	500	15/20/25/30	190/210/230

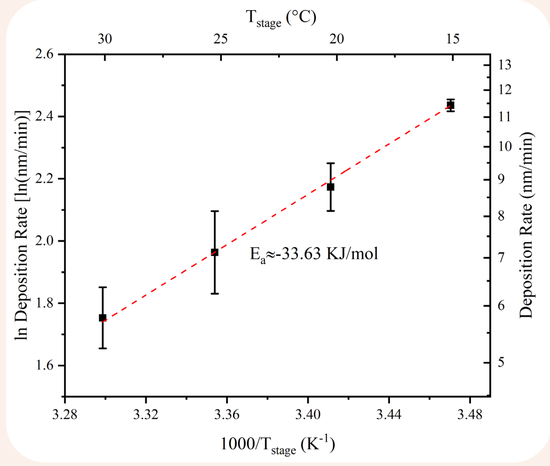


Figure 3. Effect of stage temperature on polymer deposition rate in the iCVD of AMA, the mean activation energy is -33.63 KJ/mol.

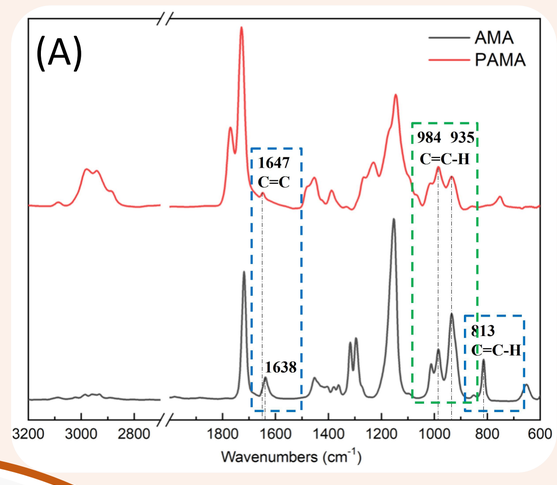
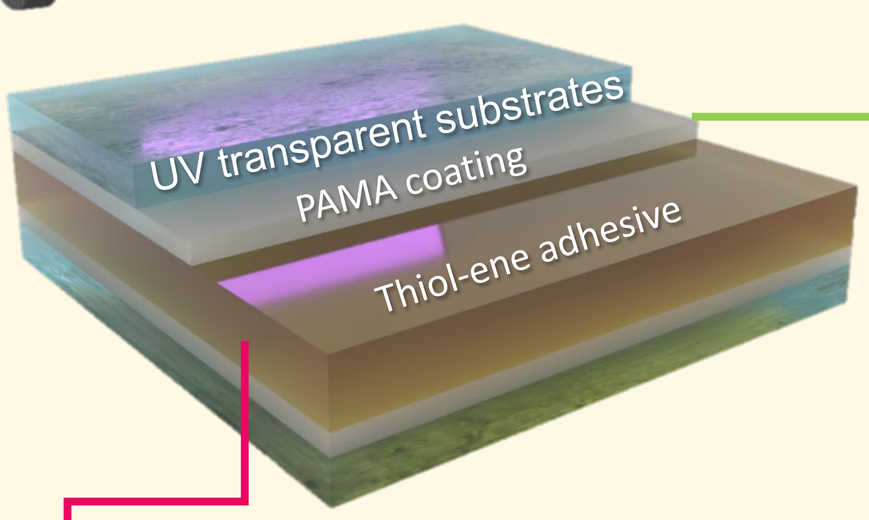


Figure 4. FTIR spectra of AMA monomer and iCVD PAMA synthesized at T_s of 15 ℃ and T_f of 190 ℃ (A) and PAMA synthesized under different T_f (B).

- Allyl group retention enables further functionalization.
- **Low T_f** favors better allyl retention.

3. Thiol-ene UV Curing System via iCVD for Adhesion Promotion



UV-cured adhesive system

Figure 5. Scheme of the preparation of thiol-ene UV-cured adhesive system.

4. Adhesion Properties

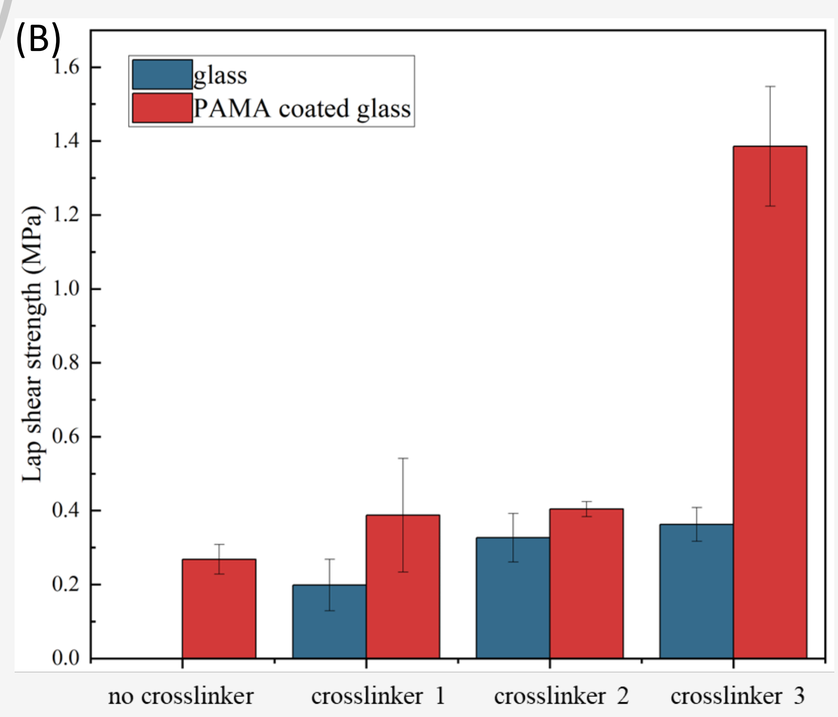
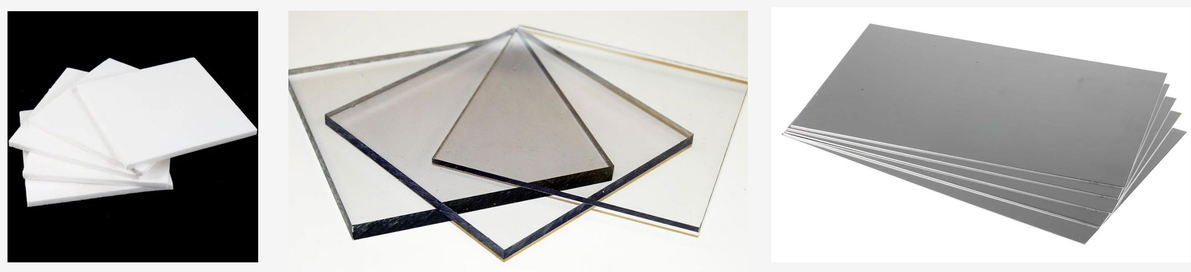


Figure 6. Scheme of the lap shear test (A) and Adhesion strengths of adhesives using different crosslinkers on glass substrates with and without PAMA coatings.

5. Future Work

Substrates with different surface energy and topography:



Teflon | PC/PMMA | Al/Stainless Steel

5. Conclusions

- iCVD's solvent-free precision enables UV-responsive PAMA films with reactive allyl groups; optimal allyl retention at T_f = 190°C.
- PAMA-modified glass showed >3-fold adhesion strength increase vs. unmodified glass with specific thiol-ene adhesive.
- iCVD PAMA nano-coatings + UV-cured thiol-ene adhesives offer a promising strategy for enhanced covalent interfacial adhesion.