D-CARBONIZE

DEVELOPMENT OF RECYCLABLE POLYCARBONATE COATINGS USING CO_2-SOURCED MONOMERS IN SOLVENT-FREE CONDITIONS

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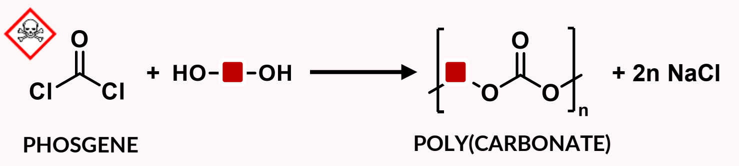
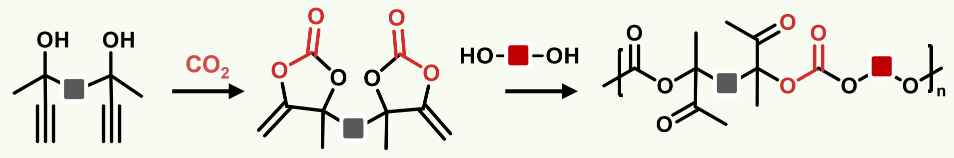
INTRODUCTION

Polycarbonates (PCs) are thermoplastics used in rigid applications (construction, electronics, automotive). Conventional synthesis relies on **toxic reagents** (phosgene), **high temperatures**, and **chlorinated solvents**.

CONVENTIONAL ROUTE TOWARDS POLY(CARBONATE)S

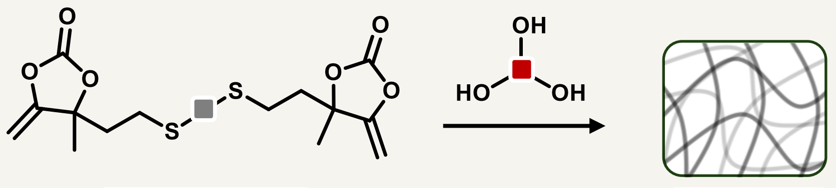


POLY(OXO-CARBONATE)S FROM ACTIVATED BIS(CYCLIC CARBONATE)S



New polycarbonates have been obtained by greener and safer **step-growth** polymerization of **CO_2-sourced activated cyclic carbonates** (BisαCC) in mild conditions.

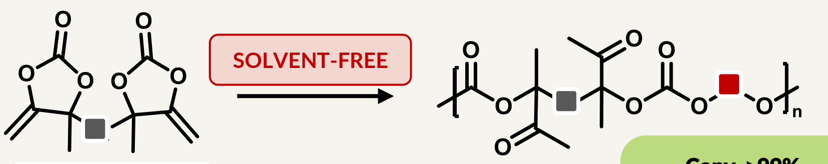
OBJECTIVE



- Solvent-free
- Step-growth no waste, O_2 tolerant
- Chemically recyclable

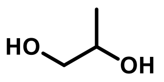
RESULTS

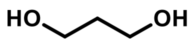
MODEL LINEAR POLYMER



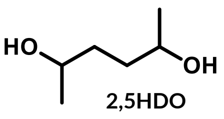
Conv. >99%
M_w = 15.000g.mol^{-1}

DIOL SCOPE

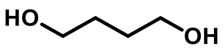




« short » diols → Cyclization



T < 40°C → Slow conversion



→ Best results

PARAMETERS

Catalyst | Temperature

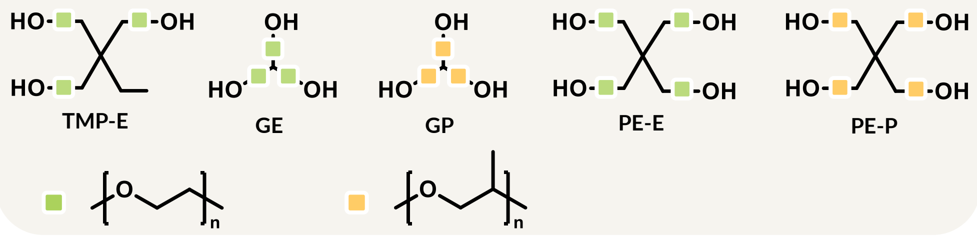
HO-?-OH
Type of alcohol

BEST CONDITIONS

DBU 2mol%
25°C- 40°C
Primary « long » OH

NETWORKS

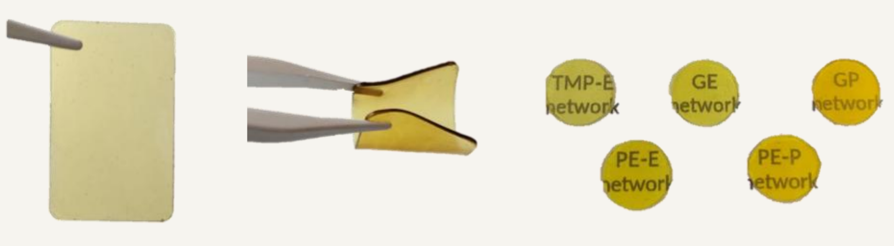
LIQUID POLYOL SCOPE



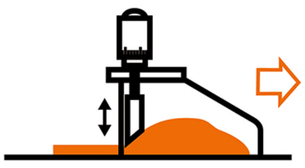
CHARACTERIZATION & MECHANICAL PROPERTIES

Sample	Gel time	Swelling Degree	Gel Content	T_g	$T_{deg5\%}$	Mechanical properties		
						E	σ	ε
	min	%	%	°C	°C	MPa	MPa	%
TMP-E network	55 min	190	96	-40	270	3.7 ± 0.3	1.1± 0.2	42± 6
GE network	25min	148	97	-38	261	3.18 ± 0.5	0.96 ± 0.1	42 ± 6
GP network	222 min	250	88	-12	256	1.8 ± 0.1	1 ± 0.1	86 ± 8
PE-E network	11 min	122	96	-29	264	5.8 ± 0.6	1.2 ± 0.2	26 ± 3
PE-P network	127 min	254	86	-15	258	1.9 ± 0.1	0.85 ± 0.1	63 ± 10

THERMOSETS WITH TUNABLE PROPERTIES



COATINGS



Aluminum susbstrate

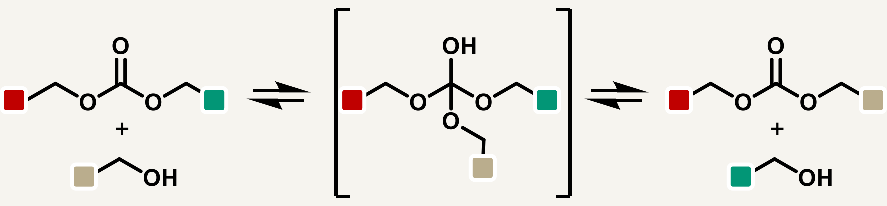
CHARACTERIZATION

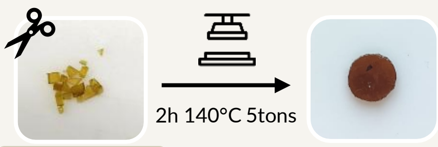
Cross-cut adhesion test
Rub test
Contact angle

CONCLUSIONS AND PERSPECTIVES

OBTENTION OF CO_2-BASED SOLVENT-FREE COATINGS CURING IN MILD CONDITIONS

TRANSCARBONATATION : TOWARDS SELF-HEALING COATINGS





-OH excess

REFERENCES

Detrembleur et al. *Angew. Chem. Int. Ed.* **2017** , Detrembleur et al. *ACS Sustain. Chem. Eng.* **2021**
Detrembleur et al. *ACS Sustain. Chem. Eng.* **2022**,, Wang et al. *ACS Appl. Polym. Mater.* **2024**

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