CHEMICAL UPCYCLING OF PLASTIC WASTE INTO SUSTAINABLE HIGH-PERFORMANCE POLYMERS

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PET-based copolyesters

TENSILE PROPERTIES

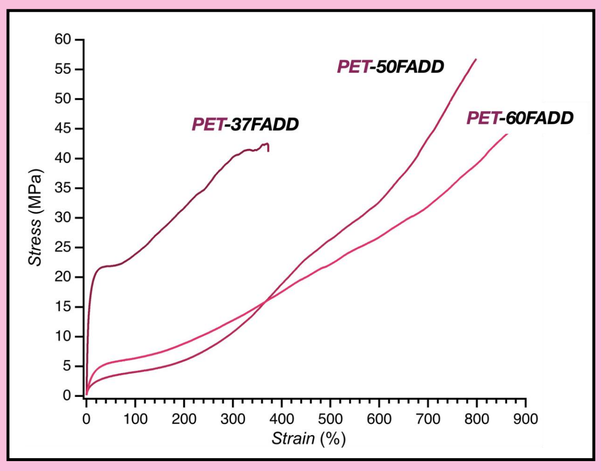
PET-FADD37

PET-FADD50

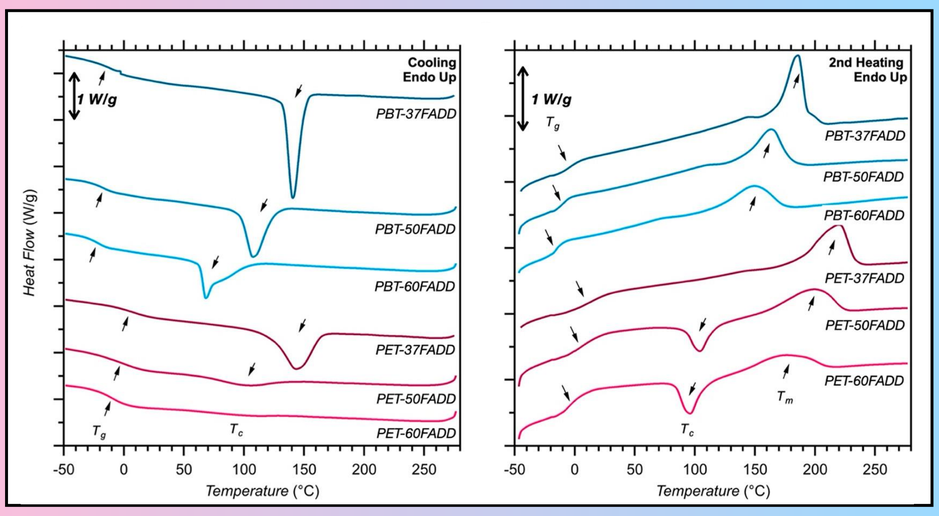
PET-FADD60

↑ FADD:
↓ Stiffness
↑ Elongation

Amorphous character



THERMAL PROPERTIES



PET-based copolyesters → **PBT-based copolyesters**

PBT-based copolyesters

TENSILE PROPERTIES

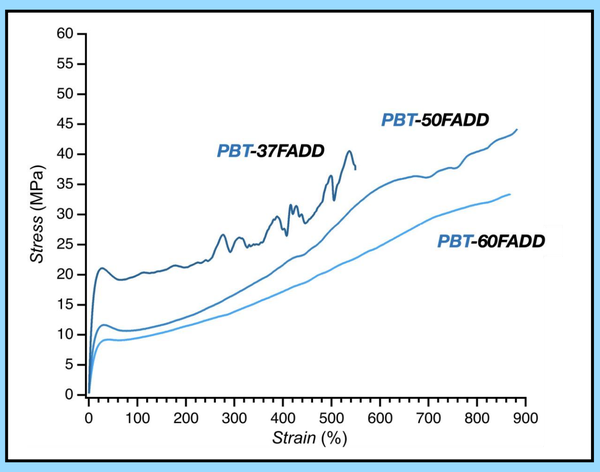
- High modulus
- High ductility

Semicrystalline structure

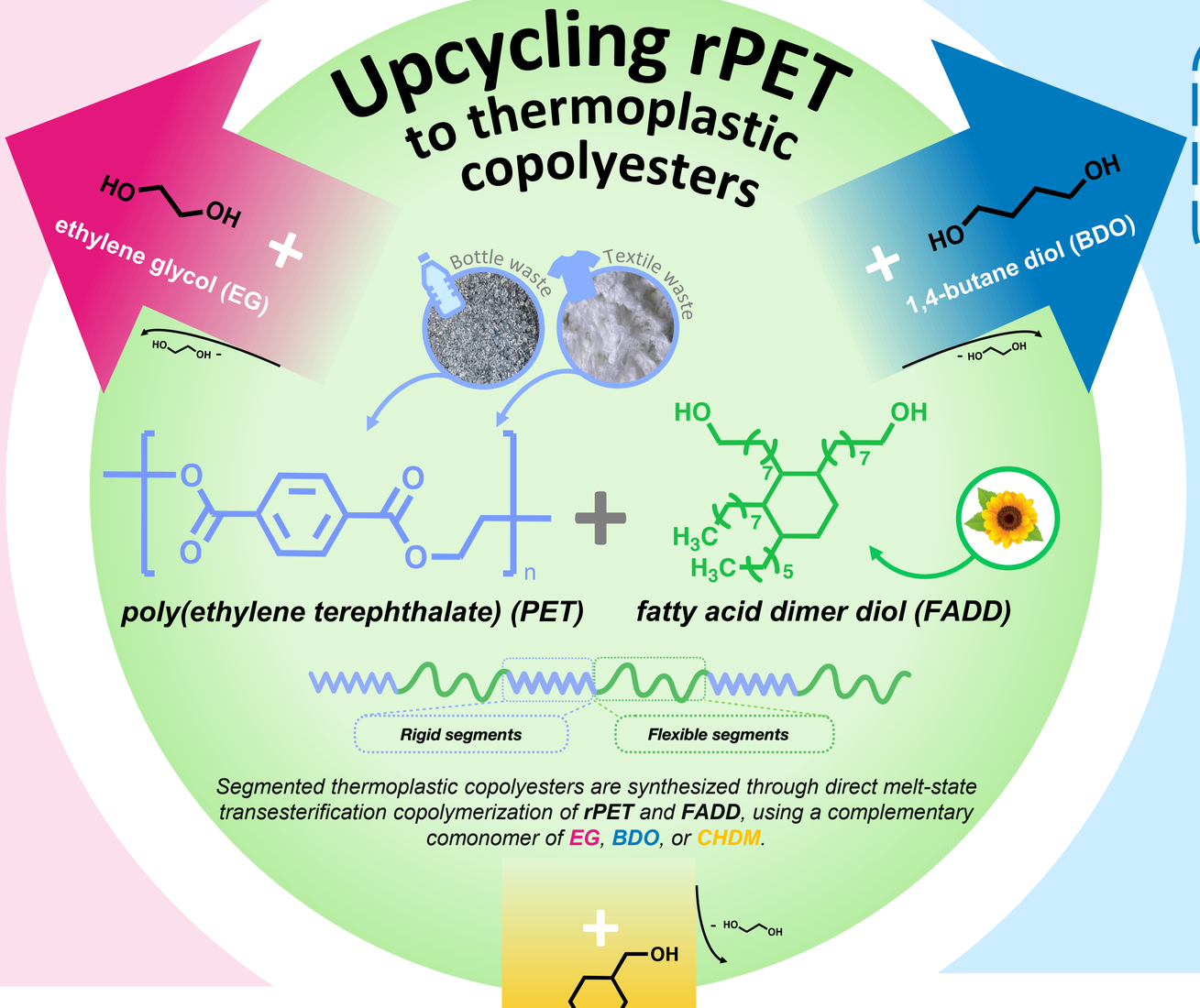
PBT-FADD37

PBT-FADD50

PBT-FADD60



Upcycling *rPET* to thermoplastic copolyesters



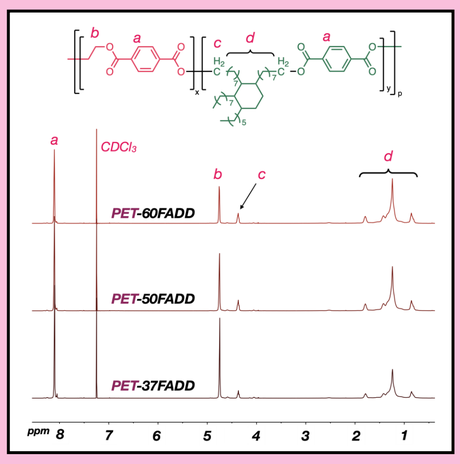
*Segmented thermoplastic copolyesters are synthesized through direct melt-state transesterification copolymerization of **rPET** and **FADD**, using a complementary comonomer of **EG**, **BDO**, or **CHDM**.*

1,4-cyclohexane dimethanol (CHDM)

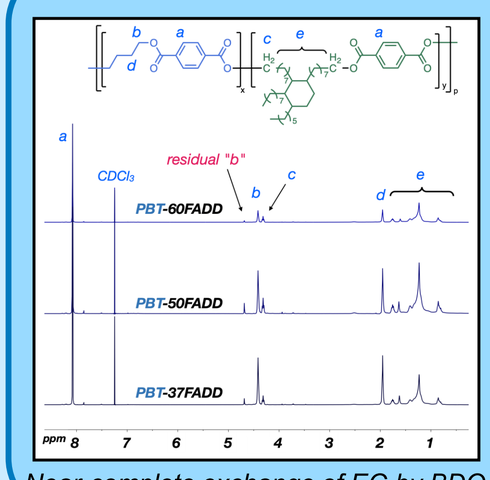
PET-FADD copolyesters

PBT-FADD copolyesters

MOLECULAR ANALYSIS



MOLECULAR ANALYSIS



Near-complete exchange of EG by BDO

PETG-based copolyesters

Hard block = statistical copolymer

Dosing enables broad compositional range

PETG-FADD copolyesters

Suppress crystallinity, reduce ductility, push toward elastomers

Effect of CHDM variation on thermomechanical properties

THERMAL PROPERTIES

LOW CHDM LEVEL

- Amorphous properties

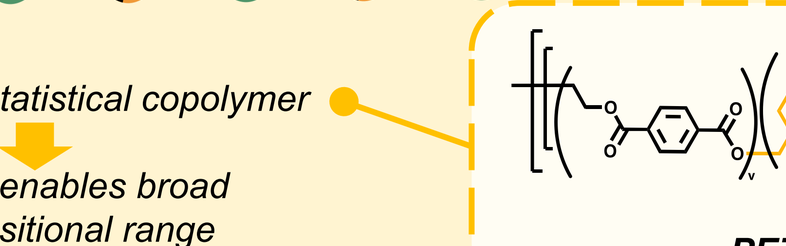
↑ FADD:
↓ T_g

Increasing FADD

HIGH CHDM LEVEL

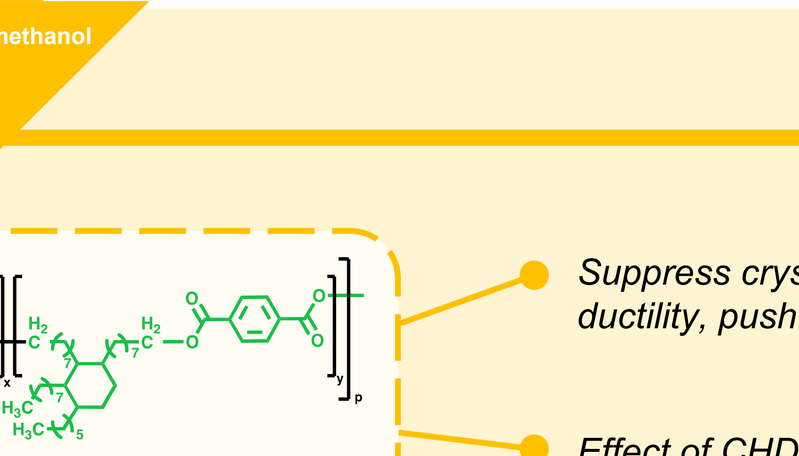
- Semi-crystalline

↑ FADD:
↓ Cryst. rate
↓ T_g



Increasing FADD

TENSILE PROPERTIES



↑ *FADD*
↓ Stiffness
↑ Elongation

↑ *CHDM*
↑ Crystallinity
↑ Stiffness
↓ Elongation

References:
- Karanastasis, A.; Safin ,V.; Damodaran, S.; Pitet, L. M. *ACS Polymers Au.* **2022,** *2* (5), 351-360
- Karanastasis, A.; Safin ,V.; Pitet, L. M. *Macromolecules* **2022,** 55 (3), 1042-1049

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