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# Open-loop recycling of post-consumer PET to closed-loop chemically recyclable high-performance polyimines

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## Résumé

Intriguing high-performance polyimines (PI) were designed from diamines recovered by open-loop recycling of postconsumer PET bottles by microwave-assisted aminolysis. These new PIs had excellent thermal properties ( $T_m = 226\text{--}286\text{ °C}$ ,  $T_g = 88\text{--}148\text{ °C}$ , heat resistance up to  $327\text{ °C}$ ) and super-high toughness and strength with Young's modulus of  $4.02\text{--}4.93\text{ GPa}$  and tensile strength of  $237\text{--}467\text{ MPa}$ , both significantly higher compared with common engineering plastics. The synthesized PIs also demonstrated recyclability "on demand" to original building blocks via mild and ultrafast acetic acid catalysed hydrolysis ( $70\text{ °C}$  for 10 min). Furthermore, the recovered monomer mixture was directly repolymerizable providing attractive closed-loop polymer-to-polymer recyclability under extremely mild conditions. These high performance thermoplastics, with easily tunable properties by selection of diamine used for aminolysis, in combination with closed-loop chemical recyclability have great promise as next-generation circular materials, designed from recycled plastics waste, for a wide property and application range.

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