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Sustainable-by-design PLA dissociative adaptable networks

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Abstract

Polylactic acid (PLA) is a biobased polymer derived from renewable resources. It exhibits valuable properties such as biodegradability and compostability under specific conditions. However, its susceptibility to hydrolytic degradation presents a challenge for its reprocessing, limiting its long-term applications. My research aims to enhance the PLA mechanical strength and toughness simultaneously by developing a specific H-bonding dissociative supramolecular adaptable network. The proposed approach involves functionalizing PLA with sextuple H-bond cross-linking unit called ODIN[1]. In my work I functionalized a linear telechelic PLA as a reference and multi-arm PLA (specifically 4-arm and 6-arm) to introduce reversible cross-linking H-bond ODIN units. I also employed different H-bonding units, such as UPY and phenyl urea to investigate how the type, number and strength H-bonding interactions affect the mechanical and rheological properties of the resulting functionalised PLA.

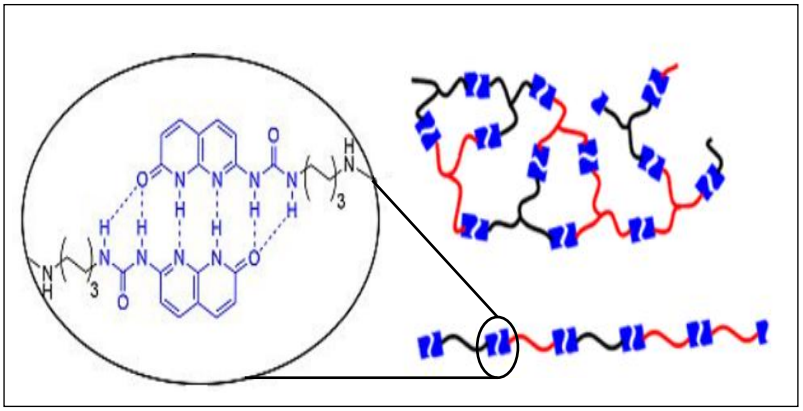

Figure. Example of PLA oligomers functionalized with ODIN[1] (blue). This allows the formation of sextuple hydrogen-bond cross-linking.

Acknowledgement

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References

1. *J. Tellers; S. Canossa; R. Pinalli; M. Soliman; J. Vachon; E. Dalcanale; Macromolecules 2018, 51,7680*