

Tailor-designed Ionic Liquid Based Solvents for Polymer Dissolution

Rubiat Sadia Mim,^{a*} Ylias Sabri,^a Mohammad Al Kobaisi ^a and Tamar Greaves ^b.

^a*School of Engineering, STEM College, RMIT University, Melbourne VIC 3000, Australia*

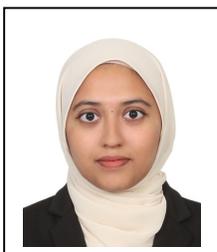
^b*School of Science, STEM College, RMIT University, Melbourne VIC 3000, Australia*

*s3986178@student.rmit.edu.au, tamar.greaves@rmit.edu.au

The worldwide demand for PV-generated power has seen a remarkable increase. Solar panels, while vital for renewable energy, introduce an additional environmental concern as they transition to the end of their operational life, transforming into a form of hazardous waste¹. Ionic liquids (IL) are compounds that typically maintain their liquid form at temperatures below 100 °C. These substances consist mostly of ions, usually comprising an organic cation and an organic or inorganic anion². Because they are composed of at least two variable elements, the anion and cation, these solvents can be custom-made for specific purposes or tailored to exhibit specific characteristics. Consequently, the term "designer solvents" has become widely used. The main aim of this research is to synthesize novel ionic liquids and assess the effectiveness of the ILs in dissolving target polymers, specifically polyvinylidene fluoride, polyvinyl fluoride and polyvinyl chloride, all of which are derived from PV solar panels and its components. A further objective is to investigate the dissolution mechanisms and the interactions between the polymer structures and the IL, an area that remains underexplored. To understand the mechanism behind the dissolution of these polymers in ionic liquid, characterization techniques such as dynamic light scattering and differential scanning calorimetry will be employed. The properties of the recovered polymer from the dissolution will be further studied for future applications. It is envisaged that development of these cheap and efficient solvents for the target polymers will enable a safer approach for end-of-life PV solar panel recyclers to adapt over the traditional methods involving flammable, toxic and volatile solvents and/or pyrolysis methods that result in toxic emissions.

References

1. Bakhiyi, B.; Labrèche, F.; Zayed, J.* *Environ. Int.* **2014**, *73*, 224-234.
2. MacFarlane, D. R.; Chong, A. L.; Forsyth, M.; Kar, M.; Vijayaraghavan, R.; Somers, A.; Pringle, J. M.* *Faraday Discuss.* **2018**, *206* (0), 9-28.



Rubiat Sadia Mim obtained her Bachelor of Chemical Engineering from Universiti Teknologi Malaysia in 2023. She is currently undertaking her doctoral studies at RMIT University under the supervision of Dr. Ylias Sabri and Prof. Tamar Greaves. Her research is centered on the design and application of ionic liquid-based solvents for polymer dissolution and related materials science applications.