Tom Hasell

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Biography:

Tom Hasell is a Reader in the Department of Chemistry and Stephenson Institute for Renewable Energy at the University of Liverpool. He is a graduate of the University of Nottingham, where he stayed to complete a PhD under the supervision of Steve Howdle (Chemistry) and Paul Brown (Engineering), while working closely with Martyn Poliakof, as well as placements in America (Eric Beckman, University of Pittsburg) and Japan (Satoshi Yoda, NIAST). He then joined Andy Cooper's group at the University of Liverpool in 2008, initially as a postdoctoral researcher and later as a research coordinator. During this time most of his research was on porous organic materials, and he played a significant role in the development of porous organic cages. After securing a Royal Society Fellowship, Tom was able to start his own independant group in Liverpool in 2015. This group is focussed on using elemental sulfur to form polymers. He has worked in a wide range of areas across materials science, including synthesis, supercritical processing, polymer science, nanoparticles and nanocomposites, dynamic covalent chemistry, and porous materials. Tom was awarded the European Young Chemist of the year award in 2014, named as a Journal of Materials Chemistry Emerging Investigator in 2017, and was awarded the RSC Macro group Young Researcher Medal in 2021.

Abstract:

Sulfur is an industrial by-product, removed as an impurity in oil-refining. This has led to vast unwanted stockpiles of sulfur and resulted in low bulk prices. Sulfur is therefore a promising alternative feedstock for polymeric materials. Sulfur normally exists as S_8 rings. On heating, these sulfur rings can open and polymerise to form long chains. However, because of the reversibility of sulfur bonds, these polymers are not stable, and decompose back to S_8 over time, even at room temperature. Inverse vulcanisation has made possible the production of high sulfur content polymers, stabilised against depolymerisation by crosslinking.[1] These high sulfur-materials show excellent potential as low-cost water filters to remove mercury.[2-4] Heavy metal contamination exists in the waste streams of many industries, and mercury is of particular concern for human health. Alternative crosslinkers for inverse vulcanisation, from industrial by-products or bio-renewable sources, can be used to reduce the cost and improve the properties of the resultant polymers.[4,5] Polymers made from sulfur also have many other intriguing properties and applications in optics, electronics, insulation, and antimicrobial materials. We recently reported a catalytic route that reduces the required reaction time, temperature, and by-products – and allows otherwise unreactive crosslinkers to be used.[6] Also discussed will be methods to improve the physical properties of the polymers,[7,8] to make them by photoinitiated[9] or milling routes,[10] or to make them water soluble.[11,12]

[1] Nat. Chem. 2013, 5, 518–524.

[2] Chem. Commun., 2016, 52, 5383 - 5386.

[3] J. Mater. Chem. A. 2017,5, 11682-11692

[4] J. Mater. Chem. A., 2017, 5, 18603

[5] Chem.-Eur. J. 2019, 25, 10433-10440

[6] Nat. Commun. 2019, 10, 647

[7] Angew.Chem.Int.Ed.2020,59,13371–13378

[8] Chem. Mater. 2022, 34, 3, 1167–1178

[9] Nat. Chem. 2022, 14, 1249–1257

[10] Nat. Commun. 2022, 13, 4824

[11] Adv. Func. Mater. 2024, 34, 2314567

[12] Adv. Func. Mater. 2024, 34, 2311647