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Constitutionally dynamic polymers as triggered release capsules

Dynamic polymers assembled through hemiaminal and aminal functionalities reversibly fragment upon binding to trivalent metals. Gels produced with these dynamic polymers are broken down to liquids after the addition of metal salts. Nuclear magnetic resonance (NMR) spectroscopy studies of intermediates and density functional theory (DFT) calculations reveal that the presence of these metals causes shifts in the energetic landscape of the intermediates in the condensation pathway to render stable non-equilibrium products. These non-equilibrium products are liquids that remain stable liquids at room temperature but convert to gel upon heating. Thermal activation causes the fragmented ligands to transform catalytically into closed-ring products which are macroscopically observable as new gels with distinct physical properties. The interplay between equilibrium and non-equilibrium gels and liquids and the ligands responsible for these transformations has been observed rheologically to offer controlled gel times dictated by the thermodynamics and kinetics of the system. This constitutionally dynamic macromolecular system offers the possibility of harnessing an equilibrium/non-equilibrium system in tandem with its inherent self-healing and triggered release properties. These non-aqueous gels show promise as vehicles for drug-release.

Biography

Peter J Boul is a Senior Research Scientist at Aramco's Houston Research Center where his research and product development focus is stimulus-responsive polymers and nanomaterials. He earned a PhD from Rice University in chemistry under the tutelage of Professor Richard E Smalley. Following a Postdoctoral stint with Professor Jean-Marie Lehn in Strasbourg in dynamic materials, he has maintained R&D materials focus at NASA, Halliburton, and Aramco. He has published over 40 peer-reviewed papers and patents in these fields.

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