Missouri S&T Chemistry Seminar

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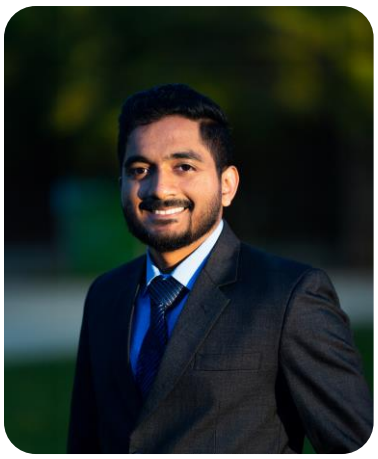

Monday, 16 September 2024

4:00 pm in 303 Schrenk Hall

Metal free self-healing preformed particle gels for conformance control

Abstract: Underground void spaces are the common cause of excess water production during secondary oil recovery leading to poor sweep efficiencies. Polymer hydrogel treatment is used to reduce void space flows to enhance oil recovery and reduce the percent of water produced. Preformed particle gels (PPG) with excellent strength and long-term hydrothermal stability are preferred over *in-situ* gels for treating void space conduits due to a potential for chromatographic separation in the latter. Self-healing in PPG (RPPG) induced by metal ions ensures reduced flow in void spaces or large pore channels and give better diversion of water into low permeability zones: this is the definition of flow conformance control. Conventional RPPG rely on metal ions like Cr^{3+}, Zr^{4+} and Al^{3+} as tackifiers to provide chain motion and entanglement between polymer chains. Use of such metal ions are limited to temperatures below 100 °C but are environmentally persistent, may be toxic in nature, and expensive. To overcome these challenges, we have developed new technologies to achieve self-healing of polymer gel particles using a class of monomers that has excellent thermal stability that act as an *in-situ* tackifier. To test our hypothesis, bulk gels were co-polymerized with the developed monomers into PPG. Bulk gels obtained from these copolymers were dried and granulated, then characterized for their swelling and rheological properties and self-healing capability at different temperatures. The mechanism of reassociation is being investigated through stress relaxation as a function of temperature, NMR relaxation, and fluorescence spectroscopic studies as a means of quantifying 'tack'. Self-healing polymer gels with excellent hydrothermal stability and elastic modulus are obtained at low crosslinker concentration as a function of polymer composition.