The Creation of Thermally Responsive POEGMA Films

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Poly(ethylene glycol)monomethyl ether methacrylates (POEGMA) are an unusual class of polymers that exhibit a lower critical solution temperatures (LCST). When the polymer is below the LCST, it is soluble in water. Above the LCST, the polymer expels the water and becomes insoluble. POEGMAs are typically viscous oil-like polymers without good mechanical properties. The objective of this project is to enhance the mechanical properties of the POEGMAs in order to utilize the LCST property to allow access to thermally-responsive mechanically robust films. These thermally responsive films could ultimately be used in drug delivery applications or as a coating on a surface to help expel water, such as in electronics or wall paint. By attaching a 2,6-bis(benzimidazolyl)pyridine (Bip) ligand unit to the ends of POEGMA and utilizing Bip ligand-metal interactions, a film was produced on account of phase separation of the ”soft” POEMGA and “hard” Bip complexes. POEGMA polymers were made via Radical Addition Fragmentation Chain Transfer (RAFT) polymerization, a controlled free radical polymerization that regulates the growth of the polymer and controls the resulting molecular weight and polydispersity (an indication of the polymers molecular weight distribution). POEGMA polymers were prepared with targeted molecular weights. The molecular weights were confirmed via Gel Permeation Chromatography. The Bip ligand was linked to the polymer through a thiol-ene reaction and the structure was confirmed via 1H Nuclear Magnetic Resonance. A UV-vis titration determines how many Bip ligands have capped the polymer chains and the quantity of metal to add. Upon the addition of a transition metal ion, such as Zinc(II), it was found that thermally-responsive POEGMA films can be formed.