Synthesis and Fire-Resistant Capabilities of Novel Ionic Polymers for Space Exploration

David King, Pradip K. Bhowmik, Ph.D.
Faculty Mentor: Pradip K. Bhowmik, Ph.D.
College of Sciences, Department of Chemistry and Biochemistry

ABSTRACT

Our rapidly advancing society developing new technologies for space exploration bears newfound safety challenges to tackle which includes fire safety and prevention. Fire resistant (FR) polymers have recently been popular materials to address this issue, but many FR polymers are not versatile in application and are toxic upon combustion. Phosphine oxide (PO) containing FR polymers are a safer alternative and provide the needed versatility for NASA's objectives, and are more environmentally friendly compared to their halogenated counterparts. This study aims to discover a class of new environmentally safe PO containing FR polymers with improved FR capabilities, increased durability, releases less toxic combustion byproducts, and offer a versatile set of important applications that is relevant to NASA's mission. The final fluorescent ionic polymers were synthesized from the ring-transmutation polymerization reaction (polycondensation reaction) from bispyrylium salts and aromatic diamine as well as metathesis reaction and were characterized using ^{1}H and ^{13}C nuclear magnetic resonance spectra, solubility properties and flame testing. The resultant ionic polymers were successfully synthesized and emits yellow fluorescence in the solution-state. Further studies can be expanded upon for fire testing, commercialization, and large-scale synthesis.