

# **Design and Synthesis of a Novel Fire Retardant Polymer for Space Exploration**

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## **ABSTRACT**

Our rapidly advancing society developing new technologies for space exploration bears newfound safety challenges to tackle which includes fire safety and prevention. Fire retardant (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. This study aims to discover a class of new environmentally safe sulfide 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 sulfide diamine as well as metathesis reaction and were characterized using  $^1\text{H}$  and  $^{13}\text{C}$  nuclear magnetic resonance spectra, solubility properties, and fluorescence measurements. The resultant ionic polymers were successfully synthesized and emit fluorescence in the solution-state. Further studies can be expanded upon for fire testing, commercialization, and large-scale synthesis.