Jou-Tsen Ou
University of Maryland

Abstract:
Although polyamides have been an industrial staple for decades, their solubility and processability remain limited due to the strong hydrogen bonding between amide groups. Here, we report a family of polyamides in which aryl rings, alkyl spacers, sulfonate groups, and amide linkages are regularly spaced along the polymer backbone, allowing us to probe the structural elements that affect processability. We accessed these polymers through a synthetic route based on an expanded diamine monomer and characterized them through a range of physical and spectroscopic techniques. Our results show that the combination of sulfonate groups with increased amide content results in highly soluble polymers, which can dissolve in polar solvents such as water, methanol, and N,N-dimethylformamide. Infrared spectroscopy on the solid polymers shows that the aliphatic amides engage in hydrogen bonding with the sulfonate groups, thus inhibiting ion aggregation, crystallization, and microphase separation. These findings expand the avenue to sulfonate-containing polyamide chemistry and provide design rules for the synthesis of more processable ionic polyamides.