

Aromatic amides for self-assembly derived materials

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Self-assembly through non-covalent interactions has proven to be a powerful tool to generate new materials with intriguing properties. Aromatic amides (aramids) are proper candidates to interact via these intermolecular forces such as aromatic stacking and hydrogen bonding. They are rigid molecules featuring high shape persistence. This is caused by the aromatic backbone and the amide bonds, which exhibit preferentially *trans*-conformation and a partial double bond character. This leads to well-defined spatial organization of functional groups and therefore to a controlled aggregation behavior. For that reasons, the presented work focused on aromatic amides for the use in non-covalent interaction derived materials.

The first project focused on aramids for low molecular weight hydrogelators for functional, smart materials. The targeted design of gelators in order to achieve distinct gel properties yet remains difficult. A set of four Y-shaped aromatic amide tetramers varying in their functional groups is presented, which are able to undergo different non-covalent interactions. These compounds were explored towards their self-assembly behavior, stimuli responsiveness and corresponding gel properties via UV-vis, rheology, SAXS and microscopic methods. It was revealed that upon minor changes in their chemical structure or gelation conditions very different gel properties are obtained. Eventually, gelators were used to form Cu(II) and Ag(I) containing gels and tested successfully for their antimicrobial effect against *E. coli* strain ATCC[®] 25922[™].

The second part of this thesis concentrates on the use of two different types of aromatic amides as rigid side chains attached to a flexible polymer backbone. One polymer possesses a rod able to interact primarily via intermolecular hydrogen bonds. In comparison, the second polymer contains a rod able to undergo preferentially π - π stacking. These two materials enabled the investigation of the distinct influence of the different side chain interactions on the materials properties. A whole set of rod-containing polymers with a varying molar fraction of rigid side chains was synthesized and investigated towards the influence on mechanical and thermal material characteristics. Results showed, that the glass transition temperature not only depended on the number of side chain rods but also on the nature of their non-covalent interactions. Higher glass transition temperatures were observed with increasing rod content. This increase was more significant for polymers with side chains able to undergo hydrogen bonding. Dynamic mechanical analysis (DMA) showed the same influence of the rods. Furthermore powder X-ray diffraction showed that these polymers did not exhibit crystallinity, which exhibited these polymers as processable polymers. The presented study can be used as a model for other polymer classes in order to influence mechanical and thermal properties of polymer materials beneficially.

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