Macromolecules with complex architecture – synthesis, properties, and applications

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Reversible-deactivation radical polymerizations, including, among others, atom transfer radical polymerization (ATRP) or addition-fragmentation chain transfer radical polymerization (RAFT), are excellent tools for the synthesis of well-defined polymers. It is possible to obtain polymers with a strictly defined molecular weight and its distribution, the assumed chemical composition of a single chain, its functionality, and topology. As a result, both the ATRP and RAFT methods opened up new perspectives in the synthesis of advanced materials and their applications. Examples include star-shaped macromolecules, molecular brushes, gradient copolymers, and multiblock copolymers. These mechanisms also make it possible to carry out polymerization reactions from the surface of solids or various biomolecules.

This presentation will show some examples of materials obtained by ATRP and RAFT polymerization, where the properties are mainly determined by the specific topology of the macromolecules and the ordering of the polymer chains. In particular, surface modifications of graphene oxide and its application in polymer blends will be presented. Examples of molecular brushes with lubricating properties will also be shown. In addition, examples of hydrogels with potential applications as dressing materials will be demonstrated.