THERMAL AND ACID LABILE POLYURETHANES AS NEW BUILDING BLOCKS FOR INTELLIGENT COLLOIDS

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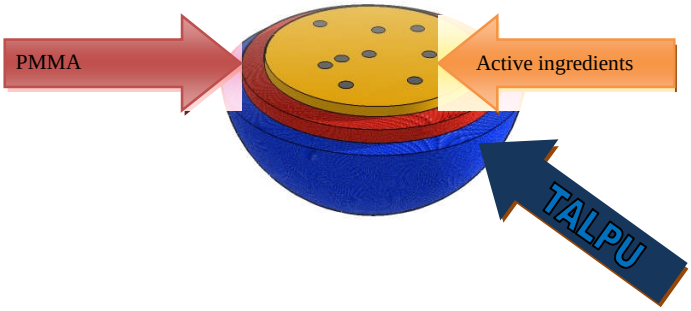
ABSTRACT

Stimuli responsive materials for delivery applications are of increasing interest not only for drug delivery, but also for material science applications like self healing coatings, sacrificial layers, etc. In contrast to medical applications, temperature and acid mediated edging is widely used to remove inorganic and organic layers or coatings and for release applications. Polymers obtained by radical polymerization are usually non degradable and therefore not suited for the applications mentioned above. In consequence, polymers made by polycondensation and polyaddition, like polyesters, polyamides and polyurethanes, are often chosen as their backbones themselves consist of functional groups.



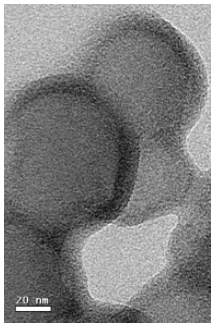


figure 1: Core-Shell Nanoparticles

Our workgroup succeeded in developing a new class of **t**hermal and **a**cid **l**abile **p**oly**u**rethanes (TALPUs) with unique properties based on tolylene-2,4-diisocyanate and 2,5-dimethyl-2,5-hexanediol. The synthesized polyurethanes are fully degradable under acidic conditions and by thermal treatment at 190 °C showing no glass transition temperature until decomposition (compare figure 2). Furthermore, TALPUs show a very good solubility in common solvents like tetrahydofuran and chloroform which make them suitable for film-forming application. We applied these Polyurethanes bearing an ATRP initiator function as a building block for hybrid blockcopolymers. The properties of radical synthesized polymers, namely easy synthesis and variety, and the functionalities of polycondensation/addition polymers can thus be combined. To obtain uniform polymers, ATRP and AGET-ATRP approaches were used to extent the initiator functionalized polyurethane with poly-methylmethacrylate and other vinyl polymers. Subsequently, the resulting polymers were employed to synthesize polymeric nanoparticles and nanocapsules. Phase-separation of the polymer block led to core-shell structures (compare figure 1).

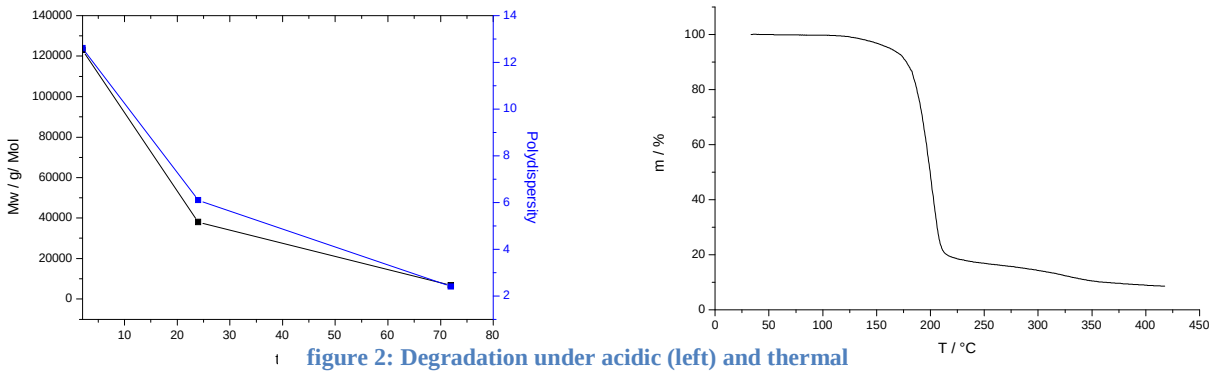


figure 2: Degradation under acidic (left) and thermal (right) conditions.