CONTROLLING POLY(UREA-FORMALDEHYDE) MICROCAPSULES PROPERTIES USING IN SITU POLYMERIZATION

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ABSTRACT

In situ polymerization is widely used for the preparation of core-shell microcapsules (MCs), due to its advantages including ease of idustralization making MCs a highly desired smart material. The most popular microcapsule systems include polyurea (PU), poly(melamine-formaldehyde) (PMF) and poly(urea-formaldehyde) (PUF) MCs. Within the current study the key process parameters of *in situ* polymerization for the formation of PUF MCs were studied, targeting at self-healing and self-lubricating applications [1-3]. Self-healing systems can offer autonomous crack repair and increase a coating's service lifetime when protective coatings fail. In case of micro-cracks microcapsules are ruptured and the healing agent flows into the crack. The released agent comes into contact with the catalyst embedded also in the matrix and is polymerized, bonding the crack faces protecting the substrate from corrosion with significant benefits for industrial applications, such as marine. The effectiveness and stability of lubrication are crucial for improving reliability and lifetime of manufactured products, also reducing wastes of natural resources and energy. Introducing microcapsules containing lubricant into the surface of moving parts, significantly improves anti-friction properties and wear resistance. When the surface is subjected to friction, the microcapsules are ruptured and the encapsulated lubricants are released onto the surface, forming a boundary lubrication film that significantly reduces the friction coefficient and wear rate.

Both epoxy resin and lubricant oil containing microcapsules with a poly(urea-formaldehyde) shell were prepared within the current study, using one step *in situ* polymerization [1]. MCs characteristics, i.e. morphology, particle size, encapsulation efficiency and thermal properties, were correlated to *in situ* polymerization key parameters such as the initial core:wall mass ratio, the pH adjustment, the stirring rate etc.

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KEYWORDS: poly(urea-formaldehyde); microcapsules; *in situ* polymerization; self-lubrication; self-healing;

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