

## PREPARATION AND CHARACTERIZATION OF UNIFORM MICRON-SIZE POLYSTYRENE PARTICLES WITH POLY(VINYLPYRROLIDONE) BRUSHES BY SURFACE-PHOTOINITIATED POLYMERIZATION IN THE PRESENCE OF A FREE RAFT AGENT

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A novel Production of hairy microparticles was described in the presence of free reversible addition-fragmentation chain transfer(RAFT) agent by a conventional photo-initiation process. Firstly, the monodisperse micron-size polystyrene(PS) seeds were prepared by emulsifier-free emulsion polymerization using potassium persulfate as thermo-initiator. Secondly, the photo-initiator containing double bond and ester group was chemically anchored on the surface of the PS seeds using starved addition with styrene. Finally, 4-cyanopentanoic acid dithiobenzoate(CPDB) as water-soluble RAFT agent was directly added into the UV-initiated emulsion polymerization PS seeds using N-Vinyl-2-pyrrolidone(NVP) as monomer and then the poly(vinyl pyrrolidone)(PVP) brushes could be obtained on the surface of PS microparticles and in the aqueous medium, respectively.

The results indicated that there were significant differences of the characteristics in polymerization and brush thickness on the shell. Figure 1 showed the comparison of PVP brush yield on the surface of PS microparticles and partitioning coefficient of the obtained brushes between on the surface of PS microparticles and in the aqueous medium when photoinitiated with and without a free RAFT agent. It was seen that the addition of free RAFT agent induced a certain decline of brush yield and a very slight decrease of partitioning coefficient which still kept over 50%. Moreover, Figure 2 clarified that the wet thickness of PVP brush would linearly and slowly increase in the presence of RAFT agent. An advisable increase of RAFT concentration in the aqueous phase could enrich the brush on the shell. And then, an impactful relationship between brush thickness and brush yield could be more clearly exhibited in Figure 3. On the contrary, an inflexion point of the brush thickness change existed in the absence of RAFT agent due to the increase of grafting density based on typical free-radical initiation.

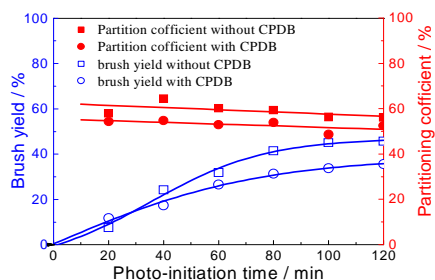


Fig.1 Comparison of both brush yield and partitioning coefficient with and without RAFT agent versus reaction time

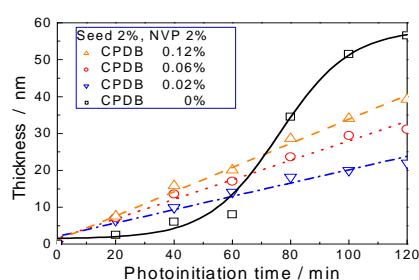


Fig.2 Influence of RAFT agent on the thickness change of hairy polymer shell at different UV-initiated reaction time

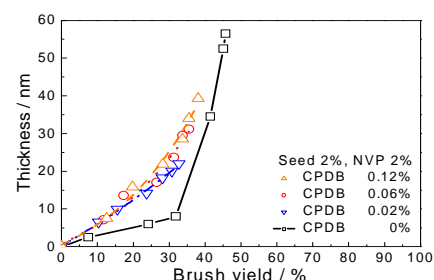


Fig.3 Thickness change of hairy polymer shell on the brush yield with or without adding RAFT agent in the aqueous medium

Furthermore, a characteristic peak of C=S double bond could be found in FT-IR spectra of the resultant PVP brush which was cut from the surface of PS microparticles through the hydrolysis of an ester group of the photoinitiator. It was denotable that the patch of RAFT agent was present at the hairy PVP grafted on the shell. To sum up, it confirmed that primary RAFT agent in aqueous medium should participate into the reaction on the surface by the effective detachment and efficient chain transfer.

More recently, We try to attach covalently either the Z-group or the R-group of the designed RAFT agent on the surface of well-defined microparticles with free photoinitiator in the solution and immobilized photoinitiator on the surface of other microparticles, respectively. Consequently, we have

been finding some interesting results.