

Polyperoxidic Surfactants for Interface Modification and Compatibilization of Polymer Colloidal Systems. II. Design of Compatibilizing Layers

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ABSTRACT: The polymer peroxide surfactants obtained by copolymerization of a peroxide monomer with maleic anhydride were either physically or chemically sorbed on the dispersed-phase surfaces, for example, on mineral fillers and latex particles. Subsequent initiation of graft copolymerization from the surface resulted in the formation of interfacial compatibilizing polymer layers in water emulsions and dispersed-filled polyethylene. The morphology of the resulting filled polymer was characterized by scanning electron microscopy. © 2000 John Wiley & Sons, Inc. *J Appl Polym Sci* 76: 1228–1239, 2000

Key words: polyperoxide surfactant; adsorption; graft copolymerization; core–shell latex; filled polyethylene

INTRODUCTION

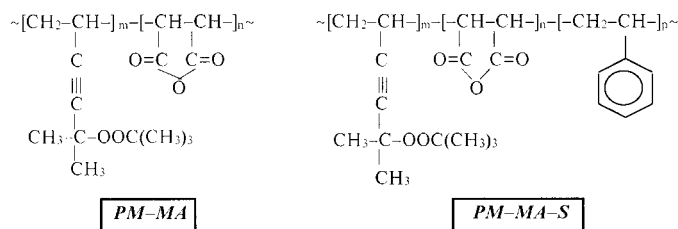
Filled polymers, aqueous polymer dispersions, as well as polymer blends are typical colloidal systems with a highly developed interface. The properties of the end products—polymer composites and latexes—are a function of the structure and properties of the interfacial layers. It follows that further advances in the chemistry of polymer composites is dependent on the possibilities of designing interfacial layers.

Compatibilization of solid polymers in melts is considered to be very similar to the stabilization of polymer colloidal particles in the aqueous phase with the use of polymeric surfactants.¹

These substances have a tendency to localize at the interface, thereby lowering surface and interfacial tensions. A similar function is performed by a compatibilizer in immiscible polymer blends. Since the late 1980s, compatibilization problems have been progressively elucidated through reactive blending, wherein along with the blending processes physical or chemical interaction may occur between the molecules of the diverse components. In particular, these processes effectively proceed when coupling agents and peroxides (radical generators) are introduced into the polymer blends.^{2,3} As proposed in the literature,⁴ the radical generator and the coupling agent should be ideally distributed at the interfacial boundary of the polymers being blended in order to maximize coupling reactions between the reactive centers. In a number of works, attempts to locate the graft-copolymerization initiating sites at the

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Scheme 1 Structure of polymer peroxide surfactants used.

phase boundary of the emulsion system^{5,6} and at the interface of polymer blends^{4,7,8} using low molecular weight peroxides and coupling agents proved to be successful. To realize these objectives, peroxide groups were immobilized on the filler surface via the chemisorption of a dicarboxylic peroxide⁹ or a functionalized dialkyl peroxide.¹⁰

For the introduction of peroxide groups onto the polymer surface, gamma irradiation,¹¹ ultraviolet light,¹² glow,¹³ and corona¹⁴ discharge treatment, ozone oxidation,¹⁵ as well as plasma treatment¹⁶ were employed. Polymer peroxide surfactants (PPS) have been synthesized by employing polymer ozonization with successive grafting of vinyl monomers onto these polymers for use as compatibilizers in polymer blends.¹⁷ Application of polymeric surfactants containing peroxide groups will obviously be promising for solving the problems involved in compatibilization. These substances are capable of lowering the surface and interfacial tensions, localizing the specific amount of radical generating sites at the interface, and initiating graft copolymerization.¹⁸ Adsorption of PPS on the surface of the dispersed phase results in the immobilization of peroxide groups at the interface.¹⁹ Polyperoxide macromolecules are capable of acting as anchor polymers; the PPS macrochains are attached to the surface either by physical adsorption or chemisorption with the surface groups. On the other hand, they can either be chemically bonded to the polymer matrix macromolecules or form grafted polymer chains capable of strong interaction with the dispersion medium.

This method allows an appropriately engineered design of interfacial layers with a definite structure and nature,²⁰ thereby permitting to separately control the interactions of the resulting polymer layer with the dispersed-phase surface and dispersion medium. In addition, it facil-

itates the optimization of the extent of these interactions.²¹ The process consists of the following stages: (i) synthesis of the PPS, (ii) its sorption on the dispersed-phase surface, and (iii) formation of compatibilizing polymer layers either by graft copolymerization of the monomers initiated from the surface or by grafting the preformed polymer macromolecules through chain-transfer reactions.²⁰

Synthesis of polymer surfactants including those with reactive groups and their applications have been well documented in the literature.^{1,22-24} At the present time, research is in progress on the quest for a universal compatibilizer.²⁵ We propose that this problem could be solved to some extent by the appropriate synthesis of the specific PPS for each particular compatibilization of colloidal system ingredients. This synthesis can be carried out by copolymerization of peroxide monomers with monomers containing other functional groups. Being that there is a wide range of both peroxide monomers, for example, hydroperoxides, peroxyesters, and dialkyl peroxides^{18,26} and vinyl monomers, the synthesis of versatile surface-active polyperoxides having various natures and reactivities becomes a technically feasible process, making it a quite promising route to the creation of compatibilizing layers.¹⁸

In a previous article,²⁷ we reported on the synthesis and notable properties of polymer surfactants with peroxide and anhydride functionalities, which are obtained through the radical copolymerization of the peroxide monomer 5-*tert*-butylperoxy-5-methyl-1-hexen-3-yne (PM) with maleic anhydride (MA) or their copolymerization with styrene (S). Their structures are shown in Scheme 1.

In aqueous solutions, these polyperoxides readily transform into the form of PPS with carboxylic acid groups (PM-MAc, PM-MAc-S) or

Table I. Characteristics of the PPS Used

PPS	Composition (mol fraction)	Anhydride Group Content (wt %)	Peroxide Group Content (wt %)	Molecular Weight
PM-MA	0.54 : 0.46	14.26	6.02	7240
PM-MA-S	0.25 : 0.49 : 0.26	18.23	3.32	23,600

salts of the latter (PM-MS, PM-MS-S) in aqueous alkaline solutions. This work was performed with the aim to investigate the applicability of PPS for interface modification and compatibilization of polymeric colloidal systems.

EXPERIMENTAL

Materials

Polymeric peroxide surfactants PM-MA and PM-MA-S were synthesized by the method described earlier,²⁷ and the characteristics of the products used are presented in Table I. The monomers used—butyl acrylate (BA) and S—were industrial products and were conventionally purified before use.

Synthesis of Polystyrene (PS) Core Latex

Emulsion polymerization of styrene was performed in a 2% w/w aqueous solution of sodium dodecyl sulfonate (SDS) supplied by Merck (Darmstadt, Germany) at a 1 : 4 monomer-to-aqueous phase w/w ratio by a method described elsewhere.²⁸ Ammonium persulfate (0.1% w/w with respect to the monomer) was used as the initiator and the process was carried out until 99% conversion, which was controlled gravimetrically by analyzing the solid residual after evaporation. The residual monomer content was estimated using gas chromatography with a Λ XM 80 equipment (Russia) in accordance to the technique reported elsewhere.²⁹ The pH values of the latexes were controlled with the aid of a pH meter I-130 (Belarus).

Surface-tension (σ) measurements were performed with a K12 KRUESS tensometer (Hamburg, Germany) by the Wilhelmy method with a platinum/iridium plate at 293 K, taking into consideration the time necessary to attain adsorption equilibrium. The saturation degree of the latex-adsorption layers was estimated by means of ad-

sorption titration³⁰ of the latex samples with SDS using surface tension measurements. Latex particle-size measurements were performed with a Malvern Zeta-Sizer 3 equipment.

Grafting of PPS onto PS Core Latex

PPS grafting onto the PS latex particle surface was performed in a glassy reactor equipped with a reflux condenser under agitation at 300 rpm and at three temperatures: 343, 353, and 363 K, for a period of 10 h. The polyperoxide was employed in the form of potassium salt (10% solution in water at pH 9) at a 4% w/w concentration relative to the PS. The grafting kinetics was simultaneously followed by two methods: adsorption titration of the latex samples and potentiometric titration of frozen serum samples.

By the first method, samples of the reaction mixture were taken and adsorption titrated every hour. The amount of grafted polyperoxide on the latex particle surface was estimated with respect to the concentration of the low molecular weight emulsifier displaced from the surface. It was established that the amount of the SDS emulsifier displaced from the polymer particle surface is directly proportional to the grafted polyperoxide amount.

For the potentiometric titration, after every 2 h of synthesis, 6 mL of the latex samples were taken, frozen in a cryostat at 261 K, and then kept in this state for a period of 20 h. Serum was removed by filtration through a blue ribbon filter paper and a $(1.0 \dots 1.2) \pm 0.0002$ g weight was sampled and added to 2 mL of a 0.1N NaOH solution. The resulting mixture was then dissolved in 50 mL of distilled water and titrated with a 0.1N HCl solution up to a pH value of 2.5. The potentiometric data were differentiated and the volume of HCl consumed on the polyperoxide carboxylic groups' titration was evaluated from the turning points. The amount of the ungrafted

polyperoxidic emulsifier was then estimated from the carboxylic group content in the serum. The statistical measurement errors were very close for these two methods of analysis, and the relative error did not exceed 10%.

Core-Shell Latex Synthesis

Core-shell latexes were synthesized in glass reactors equipped with a mechanical agitator, a capillary-type inert gas inlet, and a monomer feeder. Polymerization of the shell monomer (BA) on the surface of core latex was initiated due to either thermal decomposition of peroxide groups of PPS immobilized at a temperature of 363 K or their Redox decomposition at 313 K using an Fe^+ /disodium salt of an ethylenediamine tetraacetic acid/formaldehyde sodium bisulfide (ITF) system as the reducing agent prepared as earlier reported.³¹ The syntheses were carried out up to 99% conversion of the shell monomer. Polymerization kinetics of the BA shell monomer was studied using chromatography as indicated above, during which 3 mL of the reaction samples were mixed with 5 mL of hexane and kept under mechanical mixing for 4 h until total extraction of the unreacted shell monomer was observed. The previous experiments showed that at the reported conditions BA is extracted with hexane almost completely because of its very low solubility in water (0.2% w/w at 293 K). After mixing, the mixture was kept for 3 h for the purpose of separation and unreacted BA was estimated by chromatography. Proton NMR spectra of the peroxide monomer as well as PM-MA and PM-MAC polyperoxides grafted onto the PS core surface and the core-shell polymers with a PS core and the polyBA shell were taken with a DR $\times 500$ Bruker equipment (frequency: 500 MHz; solvent: $\text{CDCl}_3 + \text{CD}_3\text{COOD}$).

Peroxide Copolymer Adsorption

Two different types of CaCO_3 were used as received, namely, industrial chalk Saxolith 2 HE with a specific surface (S_{sp}) of 1.35 m^2/g and a reagent-grade product with 6.00 m^2/g . MgO, an industrial product with 2.77 m^2/g ; $\text{Al}(\text{OH})_3$, an industrial product with $S_{\text{sp}} = 0.68 \text{ m}^2/\text{g}$; BaSO_4 , reagent grade with $S_{\text{sp}} = 0.25 \text{ m}^2/\text{g}$; and reactive-grade solvents were also used as received. PM-MA copolymer adsorption on the MgO, BaSO_4 , CaCO_3 , and $\text{Al}(\text{OH})_3$ surfaces was carried

out by adding 10 mL of the copolymer solution in acetone to 2.5 g of the filler and the mixture was kept under mechanical stirring for 2 h. The suspension was separated by centrifugation and the resulting filler washed with acetone and, after repeated centrifugation, dried at room temperature until a constant weight. The copolymer adsorption value on the surface was evaluated from the weight loss of the filler samples upon pyrolysis at 823 K for a period of 1.5 h in the case of $\text{Al}(\text{OH})_3$ and CaCO_3 and at 973 K for a period of 1 h in the case of MgO and BaSO_4 . For CaCO_3 , the copolymer adsorption value was evaluated from the solid residual content after dissolving the filler samples in a 5 % aqueous solution of HCl.

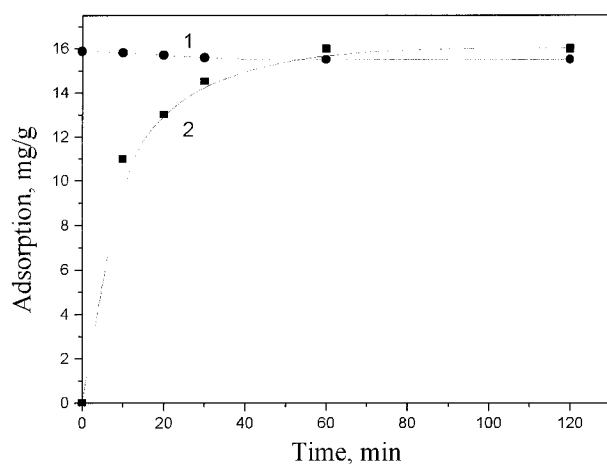
Chemisorption of PPS on a chalk surface was performed in the aqueous phase as follows: A calculated amount of the PM-MA copolymer was dissolved in a water/alkaline solution and the solution pH value was brought to 5.6 by adding HCl. Then, 20 g of CaCO_3 was added to 200 mL of a PM-MAC aqueous solution under continuous mechanical mixing. The chemisorption process occurred at a temperature of 293 K until the carbon dioxide is totally evolved, usually in 5–6 h, after which the suspension was centrifuged and peroxidized CaCO_3 was separated, washed with water, and later dried, first at room temperature, then at elevated temperature (303 K), and, finally, under a vacuum at 313 K until a constant weight. The copolymer adsorption value was evaluated as mentioned above. In both cases of physical adsorption and chemisorption, adsorption values were determined from the composition of the decomposition products of PM units in the copolymer using chromatography.³²

Polymer Filling

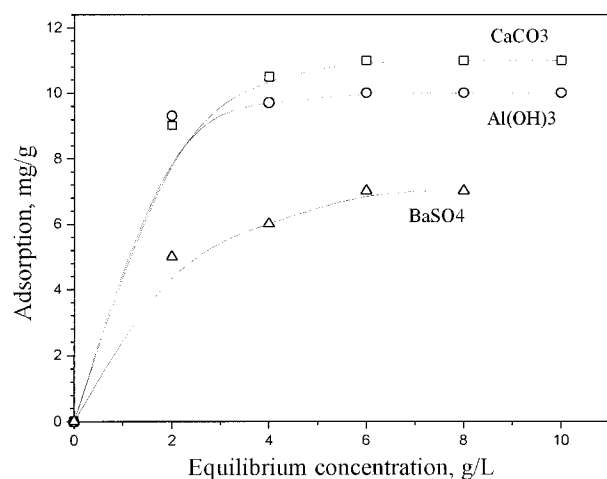
It is well known that low-density polyethylene is easily crosslinked when free-radical reactions are performed in the melt.⁷ Thus, polyethylene (Hostalen, Germany, GC 7260) was used as the polymer matrix, while peroxidized chalk with a chemisorbed PM-MAC content in the range within 0.5–2% w/w served as the active filler. The filler content was varied between 0 and 70% w/w.

The filling process was carried out by reactive extrusion in a twin-screw corotating extruder Micro 27 (Leistritz, Nurnberg) with a screw diameter of 27 mm and length-to-diameter ratio of 36. The filler was introduced by gravimetric side feeding. The flow rate was near 10 kg/h, and the

average residence time in the equipment was 2 min. Processing occurred at a temperature range of 513–535 K at 200 rpm depending on the level of the filling. The samples for mechanical testing were prepared with a Battenfeld BA 500/200 press (injection-molding machine). For the morphology studies, the filled polymer fracture samples were investigated using scanning electron microscopy (SEM, low-voltage DSM 982, Carl Zeiss, Germany).



(a)



(b)

Figure 1 (a) Kinetics of adsorption (1) and desorption (2) of PM-MA from 1% acetone solutions on MgO. (b) Adsorption isotherms of PM-MA from acetone solutions on the filler surface.

Table II. PM-MS Chemisorption on CaCO₃ from Aqueous Solutions

Initial PM-MS Concentration in Solution (%)	Adsorption Value (g/g)	PM-MS Grafting Level (%)
2.0	0.180	90
1.0	0.092	92
0.8	0.078	98
0.5	0.049	98
0.1	0.010	100

RESULTS AND DISCUSSION

Immobilization of Peroxide Groups on the Dispersed-phase Particle Surface

Physical and chemical sorption of polyperoxides are, in our opinion, the most suitable method for immobilizing the polymer initiator on the dispersed-phase surface. Physical adsorption of PPS on a solid surface is achieved when a solution of PPS is brought into contact with solids, in particular, when mixing a PPS solution in an organic solvent (acetone, dioxane, toluene, and so on) with dispersed solids such as fillers or pigments. A significant part of the polyperoxide adsorbs on the filler surface within 10 min, while adsorption equilibrium is attained after 30 min [Fig. 1(a)]. The resulting isotherms reflect Langmuir-type behavior [Fig. 1(b)].

An interesting and significant feature worthy of note is that even multiple washing of the adsorbed PM-MA molecules with solvents of a versatile nature (acetone, toluene, and aqueous solutions of low molecular weight emulsifiers) showed no remarkable change in the polyperoxide adsorption, indicating that polyperoxides are quasi-irreversibly adsorbed on the surface. This is a common feature of polymer adsorption.³³

It is clearly seen from Scheme 1 that PPS possesses two types of functionalities, that is, anhydride (carboxylic) groups and peroxide groups. Both types of functional groups could be applied for chemisorption of PPS. Immobilization of PPS macromolecules on alkaline mineral surfaces, for instance, on dispersed chalk, occurs due to an ion-exchange reaction of carboxylic groups. Likewise, peroxide group reactions are promising for modification of organic polymer surfaces.

Chemisorption of the PM-MA copolymer were performed on a chalk surface (Table II). When the

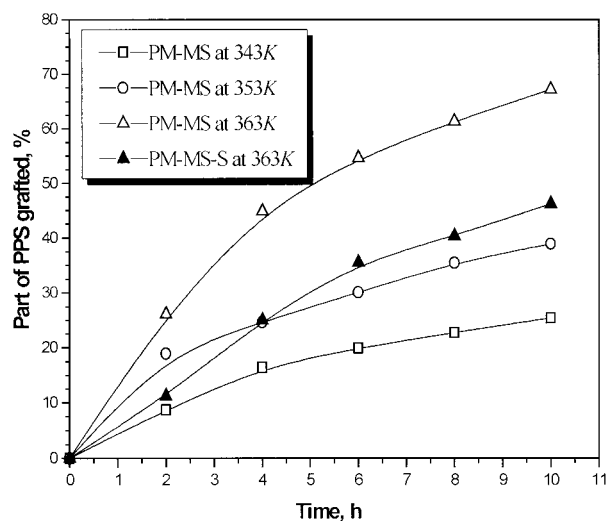


Figure 2 Grafting kinetics of PPS onto PS latex particle surface at different temperatures.

polyperoxide carboxylic group interacts with CaCO_3 in aqueous solutions, an ion-exchange reaction takes place, which proceeds with the formation of carbonic acid, the latter being detected by the evolution of carbon dioxide. Analysis of the polymer present in the equilibrium solution showed that it contained bonded calcium, whose concentration increased as the chemisorption process proceeded. This is due to the displacement of the polyperoxide calcium salt from the surface by the more active PM-Mac macromolecules. The product of this reaction (calcium salt of the carboxyl-containing polyperoxide) is slightly soluble in water, thereby precipitating on the solid-phase surface. Consequently, encapsulation of CaCO_3 particles is achieved both by polyperoxide chemisorption and precipitation of the polyperoxide calcium salt macromolecules on the particle surface. This method permits the immobilization of a significant concentration of peroxide groups (up to 10^{-3} mol/m^2) on the surface, which is of 2–3 orders of magnitude higher than that obtained during physical adsorption or chemisorption of low molecular weight initiators. Hence, this is of immense value for modifying fillers with low specific surfaces. Another very important result is that the peroxide groups are not consumed during these PPS adsorption or chemisorption processes and can be further used for the formation of compatibilizing layers through graft copolymerization of monomers or chain-transfer grafting of a preformed polymer.

Immobilization of PPS on the polymer surface was performed through reactions of PM-MS or PM-MS-S peroxide groups with PS latex particles. The amount of polyperoxide grafted onto the latex particle surface strongly depends on both the process temperature and content of peroxide groups in PPS (Fig. 2), indicating that the rate of PPS grafting is a function of the rate of peroxide group decomposition.

This fact is substantiated (Fig. 3) by the constant value of the surface tension for the process proceeding at 298 K when PPS is introduced into the latex with unsaturated adsorption layers obtained in the presence of the SDS emulsifier. When the process is carried out at 363 K, however, the surface tension diminishes due to the displacement of the low molecular weight emulsifier from the adsorption layer to the aqueous phase resulting from the decomposition of peroxide groups and PPS grafting. The constant value of the surface tension after 4 h of grafting can be explained by the fact that the amount of SDS displaced from the surface to the dispersion medium reaches the CMC value. The slight decrease in the surface tension value of latexes observed in both cases immediately after adding PM-MS (segment A–B, Fig. 3) is attributable to the surface-active properties of the polyperoxide.²⁷

It can be suggested that the process of PPS grafting onto polymer latex particles consists of the following stages: (i) polyperoxide adsorption onto the particle surface, (ii) decomposition of per-

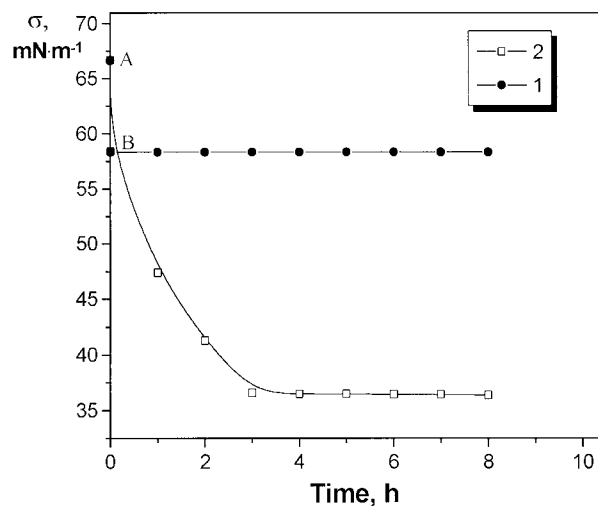
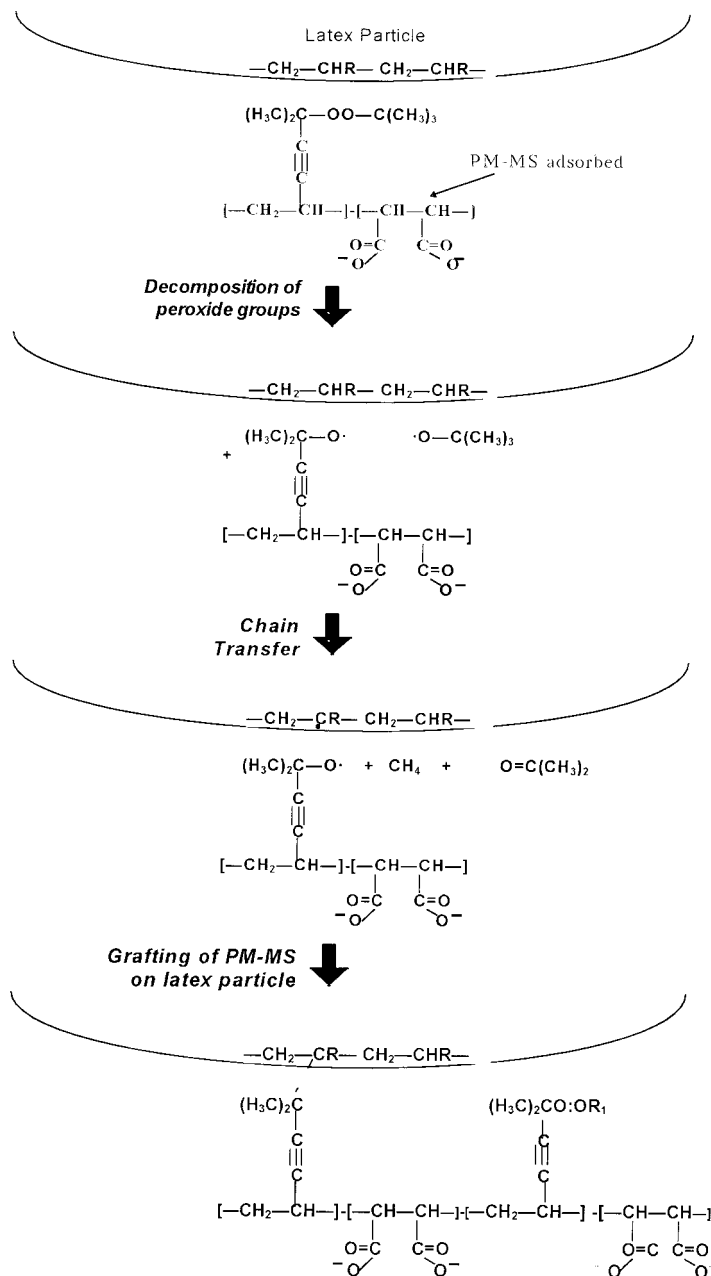


Figure 3 Surface tension (σ) of PS latex as a function of polyperoxide grafting time at temperatures of (1) 363 K and (2) 298 K at the interface.



Scheme 2 Immobilization of PM-MS on the latex particles.

oxide groups, and (iii) surface activation by a chain-transfer reaction and grafting of the polyperoxide macroradicals onto the latex particle surface, leading to the formation of reactive interfacial layers in accordance with Scheme 2.

In this process, contrary to that of PPS immobilization on mineral surfaces occurring at the expense of anhydride (carboxylic) groups, the peroxide groups of PM-MS are particularly decom-

posed in order to provide grafting of polyperoxide onto the latex particle surface. The estimated amount of peroxide groups consumed was found to be 24%. Therefore, the remaining peroxide groups could be further utilized to initiate graft copolymerization, for example, during the syntheses of core-shell latexes. The polyperoxides immobilized onto the dispersed-phase adsorption layers (e.g., mineral fillers and latex particles) have

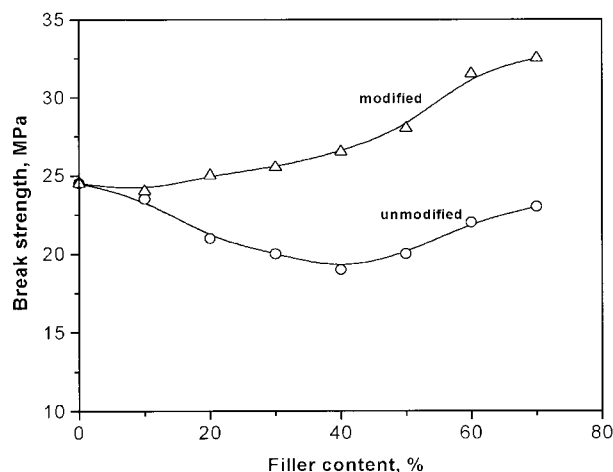


Figure 4 Effect of filler content on the break-strength value.

found potential applications for the formation of compatibilizing polymer layers, for the control of the electrosteric stability of latexes, as well as for the creation of core-shell latexes.

Formation of Interfacial Polymer Compatibilizing Layers

Chalk with polyperoxide immobilized on the surface was used for reactive extrusion of polyethylene and formation of the filler/polymer matrix interfacial layer. For the purpose of comparison, the unmodified filler was also examined. The SEM pictures of filled polyethylene fracture surfaces showed that surface modification with the aid of a PPS allows the compatibilization of the dispersed phase with the polymer matrix, owing to the grafting of its macromolecules onto the peroxide group sites and the formation of interfacial polymer layers (Fig. 4). These pictures can be interpreted as follows: When the unmodified filler is used, a typical adhesive fracture is observed along the particle surface and either the uncovered particles themselves or images of the fallen particles are clearly seen [Fig. 4(a)]. In the case of the peroxidized filler, cohesive fracture occurs through the matrix; the particles are seen only as shadows [Fig. 4(b,c)]. To make the matrix visible, which is bonded with the particle surface, the fracture surfaces were treated with dekaline. Figure 4(d) shows the filler particle of diameter $\approx 4 \mu\text{m}$, which is bonded with the matrix polymer by the polymer molecules grafted onto the surface.

Enhancement of the physicomechanical properties of filled polyethylene, for example, break strength (Fig. 5), is already achieved at a PPS concentration in the range 0.5–1% with respect to the filler, wherein the possibility of creating highly filled polymers with a filler content in the range 60–70% w/w is particularly valuable.

PS latexes with peroxide groups immobilized onto the latex particle surface were applied for synthesizing core-shell polymers. Initiation of the shell monomer polymerization processes were performed with BA either by thermal decomposition of the peroxide groups at a temperature of 363 K or by redox-initiation utilizing their interaction with the ITF system at 313 K. A comparative investigation of the change in the average particle size in the shell-formation process was performed (i) when initiation proceeded from the surface and (ii) when a water-soluble initiator $[(\text{NH}_4)_2\text{S}_2\text{O}_8]$ was employed following the technique described in the literature³⁴ (Fig. 6).

It is evident from Figure 6 (curve 2) that in the case of the polyperoxide-free route the process of core-shell particle formation yields a sharp drop in the average particle size. This is due to the fact that homogeneous nucleation of the shell polymer takes place in the aqueous phase at the initial stage of the process. Coalescence later occurs on the core surface since the adsorption layers of resulting particles are strongly unsaturated and the polymerization process finally takes place on the core-shell particle surface (curve 2, particle size growth section). It is also evident from the Figure 6 (curve 1) that the topochemistry of shell formation involving the polyperoxide is essentially different. From the beginning of the process of shell formation, shell monomer polymerization occurs on the PS latex particle surface, where the initiation sites are localized. The absence of homogeneous nucleation of polyBA particles in this case confirms the data shown in Figure 6, since an increase in the particle size is already observed at the initial stage of the process.

Proton NMR spectroscopic studies of the PM monomer and the PM-MA polyperoxide (Fig. 7) revealed that the methyl proton signals of the PM chain 1.2 ppm (1) and 1.4 ppm (2) are noteworthy.³⁵ On comparing the polyperoxide spectra [Fig. 7(a)] with that of the PPS-modified PS core [Fig. 7(b)], a multiplex in the range 6.0–7.0 ppm corresponding to the PS aromatic ring, which was absent in the former spectrum, is apparent. Peaks corresponding to the protons of the main PS

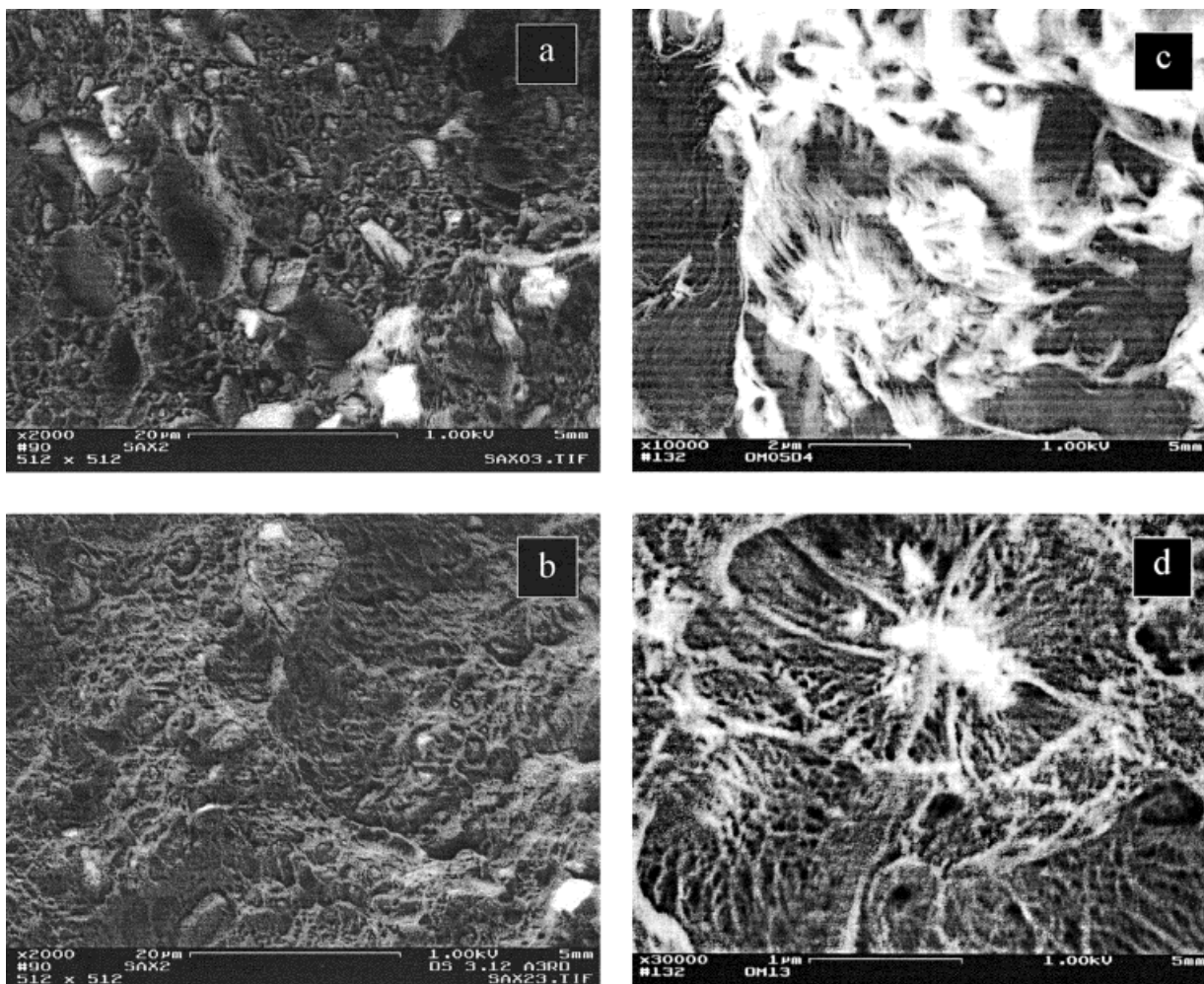


Figure 5 Scanning electron micrographs of (a) filled polyethylene fractured surfaces in the case of adhesive fracture for unmodified filler, (b) cohesive fracture along the matrix for the modified filler, (c) modified particles with grafted matrix polymer, and (d) for particles with crosslinked polymer macromolecules.

chain, 2H (3) and 1H (4), wherein peak 3 is superimposed on peak 2 of the peroxide monomer, are seen on the core polymer $^1\text{H-NMR}$ spectra in the range 1.4–1.8 ppm. The remaining spectra for the PS–PPS/PBA particles [Fig. 7(c)] revealed new peaks (5–8) corresponding to the signals of PBA shell protons.³⁵ These peaks are significantly more intensive as compared with the signals of PS core protons, although the polymerization process occurred at a PS/PBA w/w ratio of 77 : 23. This fact illustrates the formation of a core–shell structure since the spectra were taken in a solution of a $\text{CDCl}_3 + \text{CD}_3\text{COOD}$ mixture in which only the outer shell was present in the swollen state. The PS core was mainly in the form of solid particles dispersed in the solvent and stabilized by the grafted PBA chain due to polyperoxide encapsulation. These results thus enable us to conclude that particles with the PS

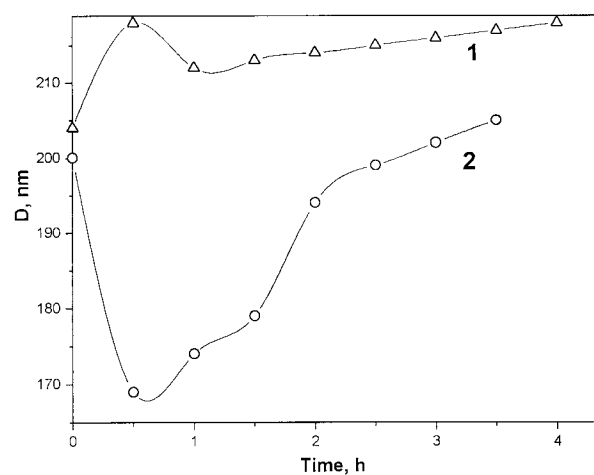


Figure 6 Change of the average particle size (D) with polymerization time (1) with the use of the polyperoxide and (2) without the polyperoxide in the presence of $(\text{NH}_4)_2\text{S}_2\text{O}_8$.

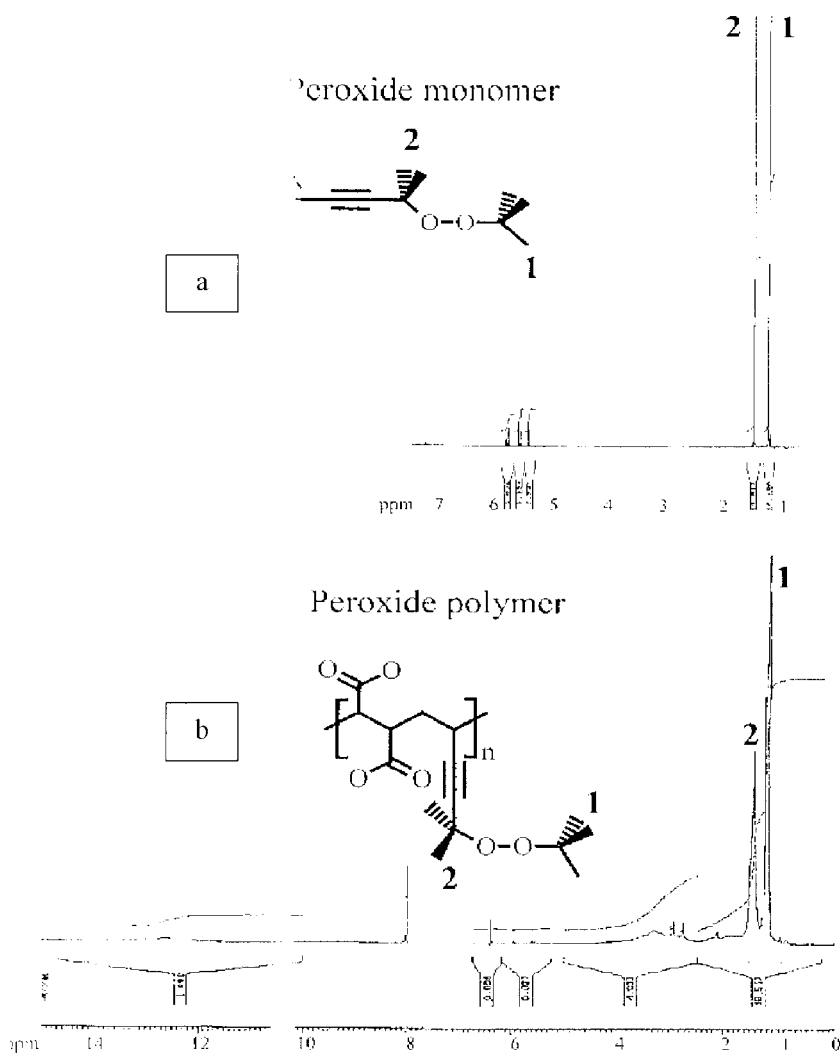


Figure 7 Proton NMR spectra of (a) the peroxide monomer, (b) the PM-MAc polyperoxide, (c) PS latex particles modified by the PM-MAc polyperoxide at 363 K in a PS-to-PM-MAc wt ratio of 100:5, (d) and the core-shell latex particles with PS/PM-MAc core and PBA shell at 363 K in a core/shell wt ratio of 100:30.

core and the PBA shell are generally formed in the process of BA polymerization initiated with polyperoxide immobilized on PS latex particles.

CONCLUSIONS

In colloidal polymer systems (water dispersions of polymers and filled polymers), the disperse phase and the dispersion medium could be compatibilized by introducing to the phase-boundary polyperoxidic surfactants which are synthesized through the copolymerization of peroxide mono-

mers like PM with other functional monomers, for example, MA.

Adsorption of polyperoxidic surfactants on the dispersed-phase surface is obviously an especially appropriate method for immobilizing peroxide groups on the interface. Furthermore, in dispersed-filled polymers, there arises the possibility of creating compatibilizing polymer layers resulting from the grafting of the matrix polymer onto the peroxidized filler surface. SEM observations confirmed the occurrence of graft copolymerization of the polymer matrix (polyethylene) on the peroxidized filler (chalk) surface. It was shown that initiating graft copolymerization from the

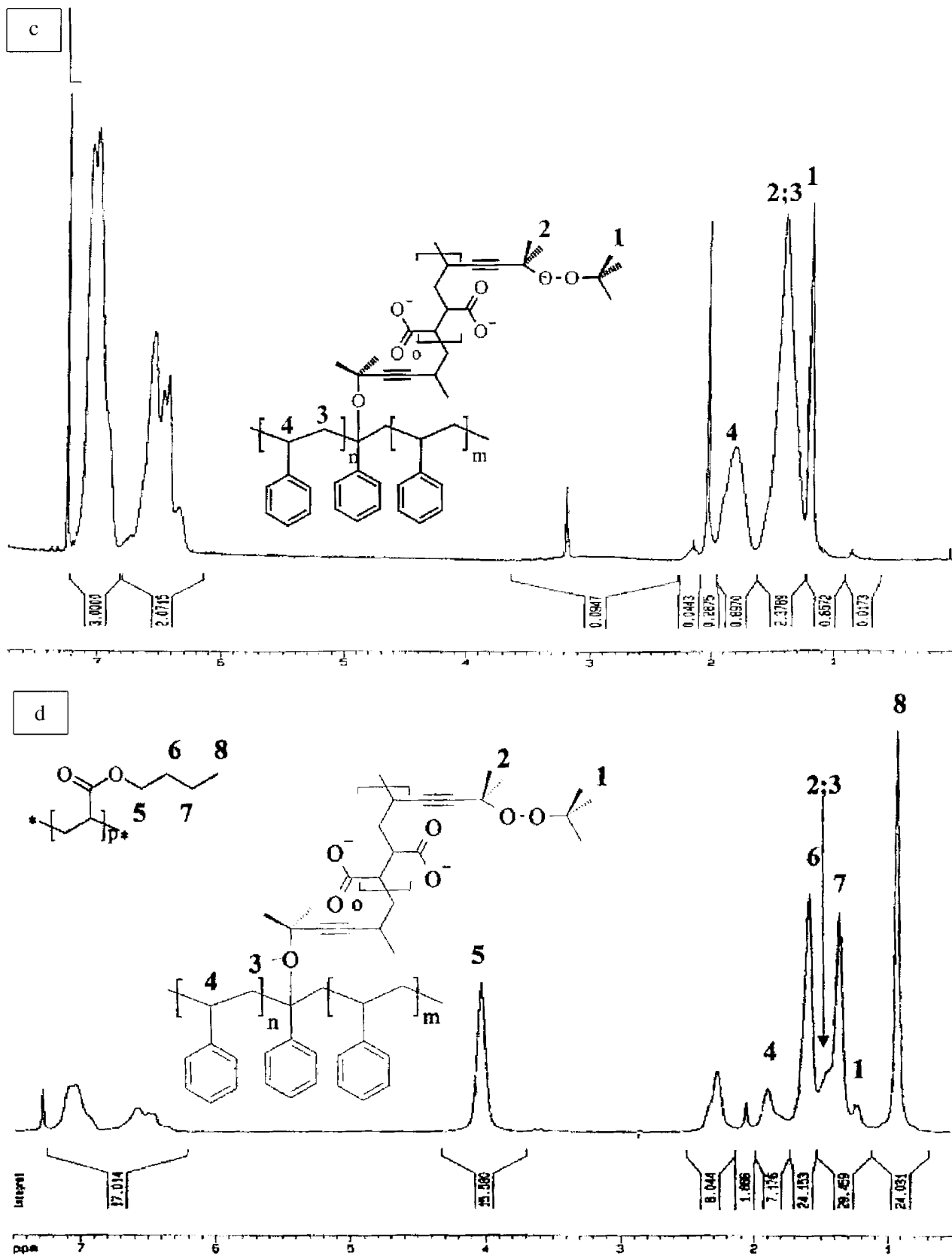


Figure 7 (Continued from the previous page)

dispersed-phase surface in water emulsions led to the formation of core-shell polymer systems. We propose that an appropriately engineered synthesis of the particular PPS would greatly contribute toward solving the problems concerning the compatibilization of the ingredients employed in water dispersions of polymers, filled polymer systems, as well as polymer blends.

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