



## COALESCENCE IN QUIESCENT POLYMER BLENDS

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Coarsening of the phase structure in immiscible polymer blends with dispersed structure annealed in the molten state was many times detected experimentally. So far, no explanation of the effect is accepted generally. An analysis of the dependence of coarsening on the blend interfacial tension showed that the coalescence and not Ostwald ripening is decisive mechanism of the coarsening at least in blends with a high or moderate interfacial tension. The course of coalescence consists of four steps: 1) Approach of the droplets. 2) Drainage of the matrix film trapped between the approaching droplets. 3) Breakup of the matrix film between the droplets after their approaching to the critical distance,  $h_c$ . 4) Relaxation of the shape of a droplet formed by the coalescence to the spherical one. It is difficult to derive theory consistently describing all steps of the coalescence. Therefore, importance of individual steps of the coalescence, depending on the distance between a droplet and its nearest neighbor,  $\langle h_0 \rangle$ , at the coalescence origin, should be estimated.  $\langle h_0 \rangle$  is available for a system of monodispersed randomly distributed spheres. For  $\langle h_0 \rangle \gg R_0$ , where  $R_0$  is the droplet radius at coalescence origin, approach of the droplets is the decisive step. Coalescence in these systems can be described by modification of the Smoluchowski theory. Results of the Smoluchowski theory of Brownian motion induced coalescence cannot be used, because approximation for the droplet flux approved for low-molecular-weight emulsions is not applicable to polymer blends. The modified Smoluchowski theory is applicable to blends with a very small volume fraction of the dispersed phase and predicts negligible coalescence. For  $R_0/2 \geq \langle h_0 \rangle \gg h_c$ , the drainage of the matrix film between practically spherical droplets controls the rate of coalescence. Approximate theories of van der Waals forces and Brownian motion induced coalescence were derived. Both the theories predict that  $R^3$  increases linearly with time of coalescence. These theories are applicable, in dependence on  $R_0$  and the droplet shape at coalescence origin, to blends with volume fraction of the dispersed phase till to several tens per cent. For blends with  $\langle h_0 \rangle$  approaching to  $h_c$ , the fact that the third step of coalescence, much faster than the matrix drainage, between a part of droplets pairs starts immediately after the coalescence origin must be considered. It leads to a strong increase in the rate of coalescence during its starting period and to its gradual decrease at further course of the coalescence. Our analysis showed us that the droplet anisometry at the coalescence origin does not affect substantially the coalescence course in blends with a high  $\langle h_0 \rangle$ . On the other hand, the droplet anisometry and arrangement strongly affect volume fraction of the dispersed phase at which  $\langle h_0 \rangle \approx h_c$ . The above results match to our experimental data.