

particles except a sharp attraction by touching each other. These stability results were consistent with the observed long-term stability of the studied MEs.

The DLS results have also been used as a means of identifying the microstructure of MEs [10, 17, 66]. In droplet MEs, the apparent diffusion coefficients (from which the droplet size of the ME was determined using the Stokes-Einstein equation) obtained at various scattering angles showed no significant difference. Besides, the angular independence of diffusion coefficients suggests that ME droplets are spherical in shape. On the other hand, bicontinuous MEs were shown to have a very high pseudo-droplet diameter and relative standard deviation, which was attributed to the dynamics and structural alterations of the bicontinuous channels. Furthermore, the apparent diffusion coefficients of bicontinuous MEs vary with the scattering angles.

36.3.3.2 Neutron Scattering from Microemulsion Droplets

The principle of neutron scattering is similar to that of light scattering. The scattering intensity of thermal neutrons from soft matter can also be expressed by Equation 36.3 [67]. In the case of light, the interaction is between the electric field of the radiation and the electronic charges. Neutrons, having no electrical charge, interact in almost all situations via their scattering length with the nuclei exclusively. Their penetration is very large and allows the study of materials containing heavy elements. The typical wavelength associated with thermal neutrons is in the order of 1 to 10 Å, which means an increased resolution. Considering the droplet sizes present in colloidal systems, it can be deduced that neutrons are very often the more appropriate way of studying their structure. Mostly small scattering angles are applied. This constitutes the technique of small-angle neutron scattering (SANS).

Shukla et al. used a core shell sphere form factor with an internal core of radius R_{core} and a scattering length density ρ_{core} surrounded by a shell with an outer radius R_{shell} and a scattering length density ρ_{shell} [67] for fitting their data. A useful expression of the structure factor $S(q)$ for hard spheres is obtained from the Percus-Yevick approximation [69].

Applying the aforementioned procedure, the authors obtained the size and polydispersity index of the two o/w MEs already investigated by DLS (Table 36.1) [20]. In their computation, a Schultz size distribution function was used, and the fits were generated by allowing R_{core} , ρ_{shell} , and σ_s to vary. As shown in Figure 36.1, the R_{core} radius corresponds to the size of the oil droplet (dark black

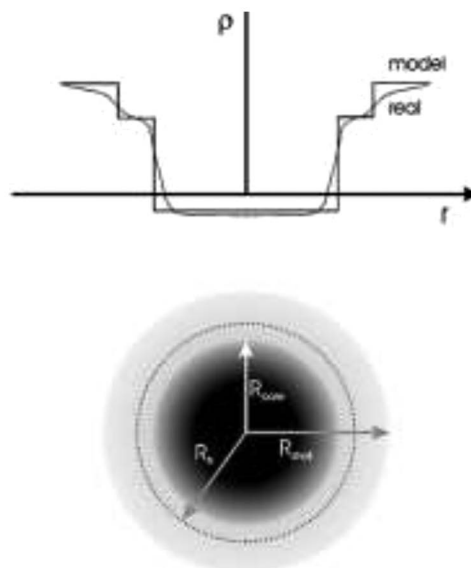


FIGURE 36.1 Model of an o/w ME droplet as a core shell sphere. (From Reference [20].)