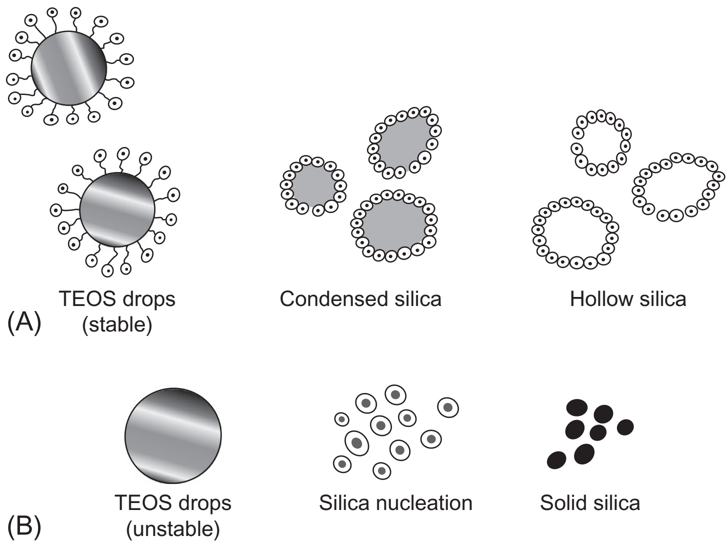

FIG. 19.1 Scheme of events during formation of hollow and solid silica spheres (A) Ethanol water ratio 0.59–0.47 and (B) Ethanol water ratio 0.42–0.37.

19.2 MECHANISM FOR HOLLOW SPHERE FORMATION

Teng et al. have proposed a mechanism scheme for mesoporous silica spheres, as shown in Fig. 19.1. This scheme highlights the importance of ethanol-to-water volume ratio so as to obtain stable oil droplets, which act as template of the hollow spheres. TEOS exist as oil droplets at optimized ethanol to water ratios in the water/ethanol solution, also containing CTAB as surfactant. A fraction of TEOS are hydrolyzed and combine with the surfactant micelles when ammonia is added as a catalyst. These micelles further get deposited along the oil-water-ethanol interface leading to formation of the mesostructured shells around the oil droplets and after calcinations hollow mesoporous silica spheres are obtained. The stability of TEOS droplets depends on the amount of ethanol; low ethanol content means less stable TEOS droplets in the emulsion system, which fail to act as templates for hollow silica spheres and thus resulting in the formation of solid silica spheres. However, mesoporous character is retained by these solid spheres due to the presence of CTAB micelles in the water/ethanol solutions and this also explains formation of different silica structures with variation in CTAB concentration.

19.2.1 Role of CTAB

The role of CTAB during MSNs synthesis is to act as a surfactant, in addition to ethanol-water ratio, the amount of CTAB greatly effects stability of oil droplets, which in turn determines structure of silica spheres. Yi et al. (2015) have