Stefan Burauer: Elektronenmikroskopie komplexer Fluide. 2002

In this thesis, Freeze Fracture Direct Imaging (FFDI), a newly developed cryo direct imaging method, is presented. This method is especially suitable for the direct imaging of complex fluids, because shear and separation artifacts caused by the use of filter paper in the conventional technique (cryo-DI) are avoided. The efficiency of the new method is demonstrated with microemulsions of the H_2O-*n*-octane-$C_{12}E_5$ system. A comparison with images taken by means of freeze fracture electron microscopy (FFEM) shows that it is, for the first time, possible to depict the bicontinuous state directly. As the major component is better visualized by FFDI, whereas it is the minor component in the FFEM, both methods complement each other. That also droplets can be depicted with the FFDI technique is shown in the H_2O-*n*-octane-$C_{12}E_5$ system. When visualizing oil-in-water droplet microemulsions, bubbles occur in the droplets. The theoretical analysis shows that these bubbles are unavoidable, as negative pressure differences of at least -10000 bar are created between the oil droplets and the surrounding water phase during the rapid freezing of the droplet microemulsion. Investigations of the systems H_2O-*n*-tetradecane-$C_{12}E_5$ and H_2O-cyclohexane-$C_{10}E_5$ confirm this hypothesis. As expected for the inverse case, i. e. water-in-oil droplets, no bubbles occur.