ESF Exploratory Workshop on

Frontiers in European Research on
Liquid Crystalline Soft Matter

LC Lab Bandol, France, May 27-29th 2009

Session ii: Drops, bubbles, tubes, foams and films

The Formation of Square Lamellae by Self-Assembled Symmetric Single-Chain Bolaamphiphiles

Annette Meister

Martin-Luther-Universität
Halle-Wittenberg
Institut für Chemie -
Physikalische Chemie
Mühlpforte 1
06108 Halle
Germany

www.chemie.uni-halle.de/annette-meister
www.chemie.uni-halle.de/bolaamphiphiles

The self-assembly of the symmetric single-chain polymethylene-1,ω-bis(phospho-cholines) (PC-Cn-PC) with chain lengths from 22 up to 32 carbon atoms and two polar phosphocholine headgroups is exclusively driven by hydrophobic interactions of the long alkyl chains. This process leads to the formation of a dense network of helical nanofibers [1]. In contrast, the single-chain bolaamphiphiles tetra- and hexa-triacontane-1,ω-diyl-bis[2-(dimethylammonio)-ethylphosphate] (Me_2PE-Cn-Me_2PE, n = 34, 36) and the partly deuterated analogue (Me_2PE-C11-(CD_2)12-C11-Me_2PE) self-assemble in water to square lamellae, a new type of amphiphilic aggregates with up to now unknown geometrical shape. In a first step, the self-assembly of these long-chain bolaamphiphiles leads to the formation of a dense network of nanofibers with strong gelling properties. Within one day, the nanofibers transform into square lamellae that grow up to an edge length of about 100 nm. The nanofibers are linked to one or two (opposite) corners of the squares in a kite-shaped way. After one week, all fibers have been transformed into square lamellae getting stacked in a gel cake. Within several weeks, a compact cake is formed by syneresis. The nanofiber-to-square lamella-transformation process as well as the underlying changes of the packing pattern were investigated by differential scanning calorimetry (DSC), Fourier transform infrared (FT-IR), transmission electron microscopy (TEM), small angle neutron scattering (SANS), and X-ray scattering.

References

[1] Meister, A.; Drescher, S.; Mey, I.; Wahab, M.; Graf, G.; Garamus, V.; Hause, G.; Mögel, H.-J.; Janshoff, A.; Dobner, B.; Blume, A. *J. Phys. Chem. B*, **112**, p. 4506 (2008)