Colloids and Surfaces A: Physicochem. Eng. Aspects 418 (2013) 39–46

Contents lists available at SciVerse ScienceDirect

Colloids and Surfaces A: Physicochemical and Engineering Aspects

journal homepage: www.elsevier.com/locate/colsurfa

# Bicontinuous microemulsions with extremely high temperature stability based on skin friendly oil and sugar surfactant

Christoph Schulreich[a], Christoph Angermann[b], Sebastian Höhn[b], Ralph Neubauer[b], Susanne Seibt[b], Ralf Stehle[c], Alain Lapp[d], André Richardt[e], Anja Diekmann[f], Thomas Hellweg[a,*]

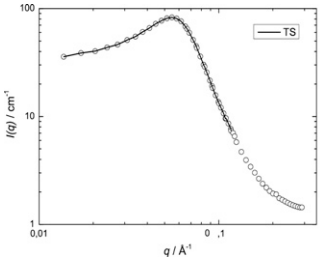
[a] Physikalische und Biophysikalische Chemie (PC III), Universität Bielefeld, Universitätsstrasse 25, 33615 Bielefeld, Germany
[b] Physikalische Chemie I, Universität Bayreuth, Universitätsstrasse 30, 95447 Bayreuth, Germany
[c] Institut für Weiche Materie und Funktionale Materialien, Helmholtz-Zentrum Berlin für Materialien und Energie, Glienicker Str. 100, 14109 Berlin, Germany
[d] Laboratoire Léon Brillouin C.E.A.-C.E.N. Saclay, 91191 Gif-sur-Yvette Cedex, France
[e] Wehrwissenschaftliches Institut für Schutztechnologien – ABC-Schutz, Humboldtstraße, 29633 Munster, Germany
[f] Physikalische und Atmosphären Chemie, Universität Bielefeld, Universitätsstraße 25, 33615 Bielefeld, Germany

## HIGHLIGHTS

- Using sugar surfactants microemulsions are stable over an extreme temperature range.
- Water can be easily supercooled in such a microemuslion.
- SANS reveals that the "renormalized" bending elasticity remains nearly constant between 261 and 343 K.
- The used oil is skin friendly.

## GRAPHICAL ABSTRACT

Sugar surfactants form very stable microemulsions, which are analyzed by means of small angle neutron scattering.




**Bicontinuous microemulsions with extremely high temperature stability based on skin friendly oil and sugar surfactant**

The use of sugar surfactants leads to the formation of very stable microemulsions, which are analyzed by means of small angle neutron scattering

## ARTICLE INFO

*Article history:*
Received 25 July 2012
Received in revised form 19 October 2012
Accepted 23 October 2012
Available online 1 November 2012

*Keywords:*
Small angle neutron scattering
Microemulsion
Phase behavior
Extra ordinary stability
Differential scanning calorimetry

## ABSTRACT

In the present article the phase behavior of microemulsions based on isononyl isononanoate (Lanol 99), sugar surfactant Simulsol SL55 ($C_{12/14}$ $G_{1.3}$), $D_2O$/water, and the cosurfactant benzyl alcohol is studied and the bicontinuous phase is identified. Using small angle neutron scattering (SANS) the internal structure of the bicontinuous phase is characterized. In the experiments a temperature range from 261 K to 343 K was covered. The prepared microemulsions were found to exhibit nearly no temperature dependence with respect to their structure and phase behavior. At low temperatures inside the microemulsions water exists in a supercooled liquid state.



## 1. Introduction

Thermodynamically stable homogeneous mixtures of non-polar solvents and polar liquids, stabilized by surfactants and sometimes cosurfactants are called microemulsions [1–4]. This name goes back to early works on this subject and today it is known that these components form nanoscale phase structures [1,2,5,6]. The differences in the phase structure result from the curvature free energy of the

* Corresponding author. Tel.: +49 5211062055.
*E-mail address:* thomas.hellweg@uni-bielefeld.de (T. Hellweg).

0927-7757/$ – see front matter © 2012 Published by Elsevier B.V.
http://dx.doi.org/10.1016/j.colsurfa.2012.10.039