ERRATA

Erratum: Temperature-dependent phase transitions in water-oil-surfactant mixtures: Experiment and theory [Phys. Rev. E 54, 3028 (1996)]

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In contrast to the remark added in Ref. [18] of our paper, the width of the two-phase region may not be neglected for the description of the latent heat of the phase transitions discussed. We present a revised derivation of the latent heat of the transitions which also allows us to explicitly state the condition under which the width of the two-phase region has no significant influence on the value of the latent heat.

The erroneous statement resulted from a fault in Eqs. (4) and (5) of our paper where a factor $4/(2\phi_w+\phi_s)$ was lost. The prediction for ΔQ from the corrected Eq. (4) is off by about a factor of 2 from the experimental data listed in Table I, whereas there is still good agreement when one accounts for the finite width of the two-phase region. To arrive at proper values for ΔQ one has to evaluate

$$\Delta Q_{L_i\to L_j}\equiv\int_{T_-}^{T_+}dT\ \ \Delta C_v(T)$$
$$=-\left(T_+\frac{\partial F_{L_j}^b(T)}{\partial T}\bigg|_{T_+}-T_-\frac{\partial F_{L_i}^b(T)}{\partial T}\bigg|_{T_-}\right)+F_{L_j}^b(T_+)-F_{L_i}^b(T_-) \tag{E.1}$$

where we took $\Delta C_v(T)=-T\partial^2F^b/\partial T^2$, while T_- and T_+ denote the lower and upper boundaries, respectively, of the two-phase region accompanied by the phase transition. The mean-field approximations $F_{L_i}^b$ and $F_{L_j}^b$ for the respective single-phase structures below and above the transition are used to evaluate the integral. This is permissible since only the values at the boundaries of the two-phase regions enter into the expression for ΔQ, and because the free energy for the present transition is differentiable with respect to temperature. Inserting Eq. (3) into Eq. (E.1) yields

$$\Delta Q_{L_1\to L_\alpha}=\Delta Q_{L_\alpha\to L_2}$$
$$=\frac{4}{2\phi_w+\phi_s}\,\frac{2\kappa T_c}{3l_s^2}\,\phi_s^2a\left(1+\frac{\overline{\kappa}}{2\kappa}\right)\left[1-\frac{3l_s(2\phi_w+\phi_s)}{2\phi_s}\;\frac{T_-+T_+}{2\,T_c}\,a\left(1+\frac{\overline{\kappa}}{2\kappa}\right)\Delta T\right], \tag{E.2}$$

where T_c is the temperature where the bending energies of the respective phases intersect (i.e., the intersections of the parabolas in Fig. 2). The expression in front of the square bracket corresponds to the corrected form of Eq. (4), while the one in square brackets accounts for the contribution from the finite width of the two-phase region. This contribution may be neglected provided that

$$\Delta T\ll\left[\frac{3l_s(2\phi_w+\phi_s)}{2\phi_s}\;\frac{T_-+T_+}{2\,T_c}\,a\left(1+\frac{\overline{\kappa}}{2\kappa}\right)\right]^{-1}\approx 57\frac{\phi_s}{2\phi_w+\phi_s}\mathrm{K}. \tag{E.3}$$

Here we used $(T_-+T_+)/(2\,T_c)\approx 1$, and the values $l_s=1.3$ nm, $a=1.2\ 10^5\ \mathrm{K}^{-1}\ \mathrm{cm}^{-1}$, and $1+\overline{\kappa}/(2\kappa)=0.75$ for the material constants (cf. original article).

The value for ΔT can be estimated from the experimental data shown in Fig. 1, leading to $\Delta T\equiv T_+-T_-\approx 4$ K for the width of the two-phase region. For the data listed in Table I, we have $\phi_s=0.18$ and $2\phi_w+\phi_s=1$ so that, accounting for the width of the two-phase region, the latent heat decreases by about 40%. Taking this into account, we find

$$\Delta Q_{L_1\to L_\alpha}\approx 0.28\frac{\mathrm{J}}{\mathrm{cm}^3}. \tag{E.4}$$

In view of the errors in the experimentally determined parameters of the free energy (in particular, the value of ΔT and the limited accuracy of a mean-field theory), there is good agreement between this theoretical prediction and the experimental results listed in Table I.

