Emulsion Polymers Consulting and Education, LLC

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Water Absorption into Polymer Films
Tutorial Outline
September, 2023

1. What makes polymer films absorb water?
2. What is the physical structure of water in polymer films? Where is the water located? Are there differences between solvent and water borne films?
3. Film properties that change when water is absorbed (Tg, density, haziness, etc.)
4. How are these properties measured? (DSC, microbalance, light scattering, etc.)
5. Equilibrium (saturated) water absorption conditions
    a. Equilbrium data for simple polymers (non-polar and polar polymers, DSC, SEM, gravimetric)
        Effect of absorption temperature vs. dry Tg of polymer, potential effect of crosslinking
        Three steps to water whitening (blushing) of simple polymers
    b. Equilibrium data for water borne films
        Mechanism of absorption for water borne (latex) films – contrast to solvent borne films
        Roles of residual surfactants and other water soluble components
        Impact of vinyl acids and pH
6. Kinetics of water absorption
    a. Rates of water absorption into ***solvent borne films*** – kinetic models
    b. Rates of water absorption into ***water borne films*** – contrast to solvent borne films
        Importance of surfactants (and chemistry) and other water soluble components
7. Discussion of methods to restrict water absorption into polymer films
    a. Polymer Tg vs. absorption temperature
    b. Crosslinked nature of the polymer in the film
    c. Use of reactive surfactants in latex production
8. Where are data lacking in the open literature?
9. Conclusions