Supporting Information for Microgel Adhesives for Wet Cellulose – Measurements and Modeling by Quan Wen and Robert Pelton

Section 1 – Locus of Adhesive Failure

The goal of this experiment was to determine is failure occurred at the microgel/microgel interface or the microgel/cellulose interface.

Fluorescently Labeled Microgels: 10 ml of FITC (1 mg/ml in dimethylsulfoxide) was added to 50 ml (2 mg/ml in water) of VAA MG with adsorbed 10 kDa PVAm. The mixture was stirred for 10 h at 4 °C and the pH of mixture was maintained at 9. The reaction was quenched by the addition of 2M NH_4Cl. The labeled microgels were purified by repeated centrifugation, decantation and redispersion.

The distribution of labeled microgels on wet cellulose was studied by confocal laser scanning microscopy system (Zeiss, model LSM 510). The excitation wavelength was 488 nm and the membrane surface was imaged by a Fluar 20× objective lens.

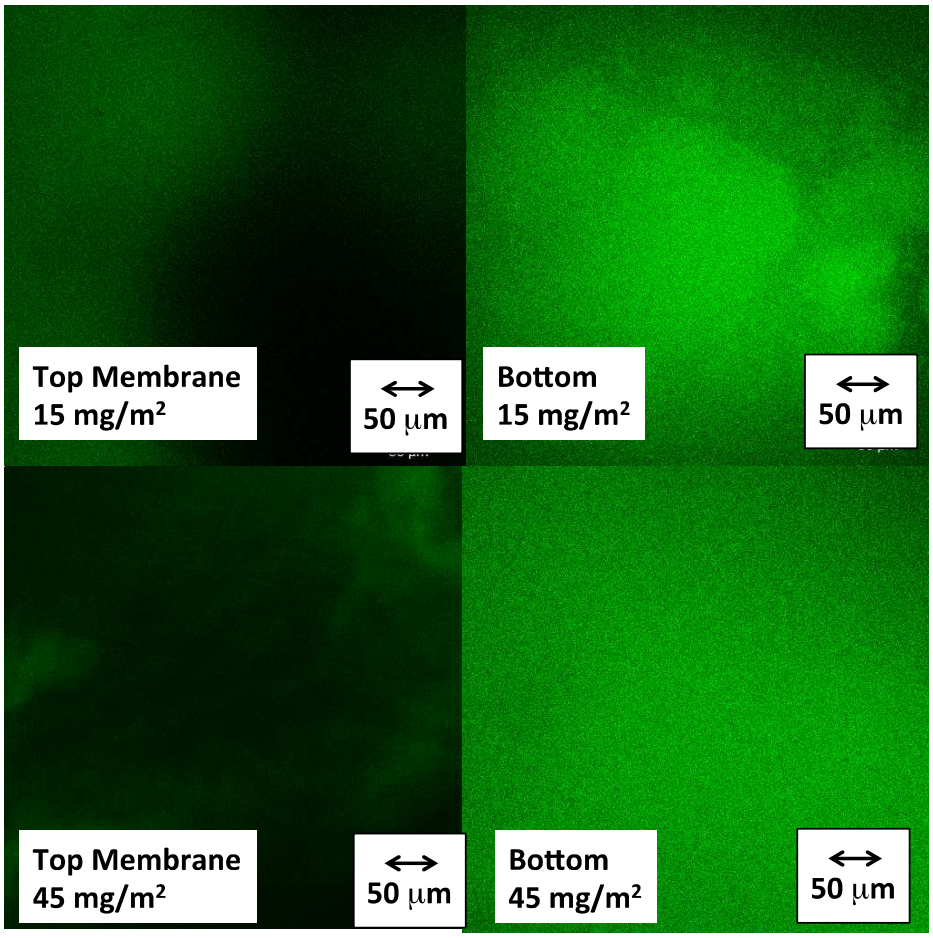

Figure 1 CLSM images of delaminated cellulose membranes. MGs were labeled with FITC

Two sets of laminates were prepared, one with a coverage of 15 mg/2 and the other with

45 mg/m2. After delamination the surfaces were examined by confocal laser scanning microscopy. Figure 1 shows example micrographs from the two coverages. In both cases most of the microgels stayed with the bottom membrane indicating that failure occurred mainly at the microgel/cellulose interface.

Section 2 – Justifying the Following Equations

$$n = 2\frac{\Gamma}{\Gamma_{sat}} n_{\max} = \frac{\Gamma}{\Gamma_{sat}} \frac{8}{\pi D^2} \lambda_m \qquad \text{for } \Gamma/\Gamma_{sat} < 0.5 \qquad 1$$

$$n = n_{\max} = \frac{4}{\pi D^2} \lambda_m \qquad \text{for } \Gamma/\Gamma_{sat} \geq 0.5$$

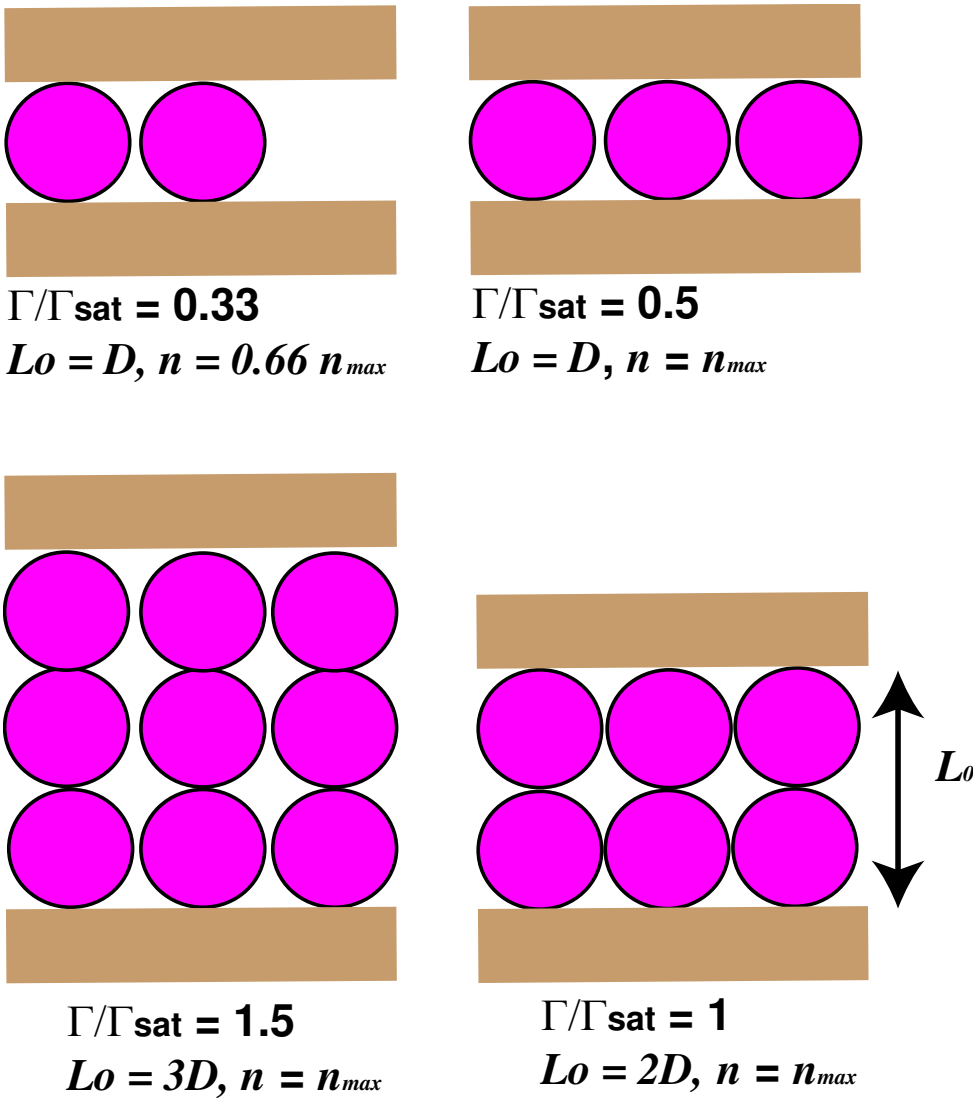

Figure 2 Illustrating the relationship between microgel coverage, Γ, and un-extended spring (microgel) length, L_0

$$L_0 = 2D\frac{\Gamma}{\Gamma_{sat}}$$

Inspection of the various cases in Figure 2 reveals that eq 1 is correct whereas eq 2 is correct only when there are no partial layers of microgels. With partial layers such as with $\Gamma/\Gamma_{sat} = 0.33$, eq 2 is an approximation.