STANDARD ADHESION MEASUREMENTS
Shannon Bays
February, 2002

A. Sample Preparation

1. <u>Cleave mica</u> - Prepare thin, rectangular mica samples (~ 1cm x 2cm). Peel off external layers of mica by using scotch tape. Care must be taken not to contaminate the freshly exposed mica surfaces.

2. <u>Clean mica</u> - If further cleaning is prescribed, prepare a wash solution containing 9 parts H_2O_2 (30% solution) and 1 part NH_4OH (20% solution). Place slides in solution and agitate with sonicator for 30 minutes. Remove and let set in hood overnight. Then remove mica and rinse extensively in double distilled water.

3. <u>Condition mica</u> - Place each piece of mica in prescribed brine to wet surface. The brine recipes can be found in the database under queries. Then, drain each piece and transfer to a second container of brine. Allow mica to soak for 24 hours.

4. <u>Drain mica</u> - Remove each piece of mica from the brine solution with tweezers, taking care to grip the mica by the edges as not to damage the mica surfaces. Transfer the mica to a contact angle cell containing about 8-10ml of the prescribed brine (this should be the same strength and pH as was soaked in).

B. Adhesion Measurement

1. Apply a single drop of the crude oil to the surface of mica using a Gilmont® buret. Increase the size of the drop slightly causing the drop to expand over the surface (Fig. 1).
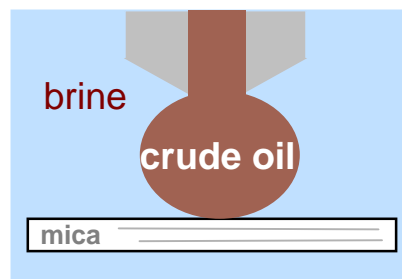

Figure 1

2. Allow 2 minutes of contact time for standard measurements. The results of longer contact tests should be reported as a function of contact time.

3. Retract the drop, and record whether the drop adhered (a drop of oil remains on the mica surfaces), did not adhered (no oil remains on the mica surfaces), or was intermediate.

4. Also note whether or not the drop has rigid films.

Repeat part B for about 10 to 12 drops on each piece of mica.

C. Adhesion Map and Adhesion Index

For a given crude oil, adhesion behavior can vary with the pH and the concentration of the brine. A standard set of adhesion tests covers the range of pH from 4 to 8 and ionic strength from 0.01 to $1M$, as summarized in the adhesion map in Fig. 2. Finally, an adhesion index can be calculated by assigning A=1, T=0.5, and N=0 and summing the values for all nine conditions in the standard matrix.

A = Adhesion, N = Non-adhesion, T = Transition (Intermediate)

$I = 0.01M$	$0.1M$	$1M$
pH 8 N	A	A
pH 6 A	A	A
pH 4 A	A	T

Figure 2