Method for Evaluation of Thixotropic Slurries in Terms of Gel Strength

Introduction

Due to the special rheological behavior of thixotropic slurries, a standardized procedure to evaluate the gel strength has been developed.

Rheological Evaluation of Thixotropic Slurries

(A) Prepare two identical slurries according to the method specified by the API. Pour one slurry into the Fann V-G Meter slurry cup for immediate rheological evaluation. Place the other slurry in a consistometer for 20 minutes for later evaluation.

Gradually lift the slurry cup to measurement position with the motor running at 600 M. Continue stirring at 600 RPM for one minute or until viscosity reading stabilizes. Stop the motor and allow slurry to remain undisturbed for the indicated rest period. Restart the motor at 3 RPM. Note the maximum reading the meter reaches fore the gel breaks. Also note the minimum value to which the meter falls after the gel breaks. Change peed back to 600 RPM and allow slurry to become thoroughly dispersed. Note Chang viscosity value indicated by the meter. Some agitation with a stiffing rod may be necessary to accomplish this. Continue the 600-RPM speed for one minute and then stop for the next rest period. Continue with this procedure until all rest periods have been covered. Recommended rest periods are: 1, 3, 5, 10, 20, and 30 minutes.

(C) Evaluate the rheology of the slurry that has been stirred for 20 minutes. The procedure described in Step 2 is follow with this slurry also. The data collected from this slurry is very important because it better approximates a field application and will relate to the durability of the thixotropic nature o the cement slurry.

Interpretation of Data

(1) Gel Strength

It has been determined that a gel strength between 100 and 200 LB/ 100 ft2 is sufficient for the slurry to be self-supporting. A value within this range should be attained after the 5-minute rest period. The maximum gel strength, above which pumping problems would occur has yet to be determined. If is known that gel strengths running into the thousands of pounds per hundred square feet are problematic because pumps at the well sites cannot exert sufficient force to break such a gel. A tentative estimate of the maximum permissible gel strength for a thixotropic slurry is about 500 LB/100 ft2.

(2) Degree of Thixotropic

After the gel breaks it is important that the viscosity fall back to a level that would permit easy pumping. In general, the meter reading should fall to a level below 50 LB/100 ft2 after the gel is broken. Thus, an ideal- case would be for the slurry to maintain a gel strength of about 150 to 200 LB/ 100 ft2 and then fall back to 40 or so. The difference between the high and low values relates to the degree of thixotropy the system is exhibiting. The greater the difference is, the better the performance as a thixotropic slurry.

(3) 600 RPM Reading

This value is important because it indicates the viscosity that the pumps would have to contend with during placement of the slurry. In general, the 600 RPM- value should not exceed 300 (spring bob: 1). Most thixotropic slurries will give reading between 200 and 270 at this speed.

Conclusion

The method of evaluation and interpretation described here should be of value. It is important that it be realized that the criteria specified here are not absolute. These measurements are heavily dependent upon the composition of the slurry, the peculiarities of the Fann instrument, and many other factors. The trend of the measured data is what is important here.