

Application Notes - Viscosity Measurement

Most laboratory viscometers employ the well-known principle of rotational viscometers to measure viscosity by sensing the torque required to rotate a spindle at a constant speed while it is immersed in the sample fluid. This is because the torque, generally measured using the reaction torque on the motor, is proportional to the viscous drag on the immersed spindle and thus the viscosity of the fluid.

AEA Technology wished to measure the consistency of cement mixes for pressure injection into containers full of radioactive waste because it is vital that the mixture is injected at the correct consistency to ensure it fills all the air spaces but yet still sets correctly.

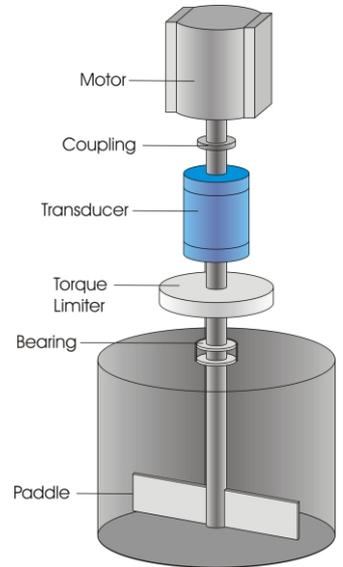
AEA found that this could only be achieved by using Sensor Technology's Rotary Torque equipment and accurately measuring the drive torque required to turn the mixer paddle during mixing. Many other applications mixing fluids with solids in suspension have been similarly measured since this work, such as plaster mixes, coal slurry, and magnetic particles in fluid as it is very difficult to measure the viscosity of these by normal methods and in most cases online monitoring is required.

There are many other applications where it is necessary to monitor the viscosity of the fluid during mixing, for example during the manufacture of shampoos and pharmaceutical solutions. Again, it is important in such applications that the relative viscosity is known during mixing, in order to ascertain when the process is completed and the viscosity or consistency is at optimum.

Operation

Provided that the motor speed is constant, the torque will vary with changes in viscosity during mixing, and thus enable the operator to measure the relative viscosity of the mix. The relationship between the torque and the absolute viscosity is controlled by the paddle type and size, which will be designed for optimum mixing. Classic viscosity measuring systems use a cylinder rather than a paddle but of course a cylinder is not effective for mixing, and thus absolute viscosity cannot usually be measured during the mixing process.

Installation



The Rotary Torque Transducer is mounted between the motor and the paddle. As the rotary transducers can be sensitive to side loads, it is essential that the paddle is not directly connected to the transducer but that double bearings are used to eliminate any side loads. See [Transducer Installation Guide](#).

Many mixers are driven by motors which are many times more powerful than they need to be, and so a stoppage of the paddle mechanism can lead to the inline torque transducer being severely overstrained or broken. Consideration should be given to protecting the transducer with a torque-limiting couplings.

The relative reading can be related to the absolute viscosity by measuring a known relative sample in a laboratory viscometer to obtain its absolute reading and thus find the optimum relative torque figure, which represents the required viscosity.