

RHEOLOGY



Rheology is the study of the flow of matter, primarily in the liquid state, but also as 'soft solids'. This applies to substances which have a complex microstructure, such as muds, sludges, suspensions, polymers and other glass formers (e.g., silicates), as well as many foods and additives, biological materials and bodily fluids (e.g., blood).

Rheology is also concerned with establishing predictions for mechanical behaviour (on the continuum mechanical scale) based on the micro- or nanostructure of the material.

Stress and Strain Rheometers are available at the centre to measure the way in which a liquid, suspension or slurry flows in response to applied forces. They are used for those fluids which cannot be defined by a single value of viscosity and therefore require more parameters to be set and measured than is the case for a viscometer.

EQUIPMENT

- 3 x AR-G2 single head rheometers (TA Instruments)
- 2 x ARES-G2 double head rheometers (TA Instruments)
- Dielectric measurement and interfacial rheology
- Combined rheometry and light scattering
- Patient room

SPECIFICATIONS

AR-G2 RHEOMETER

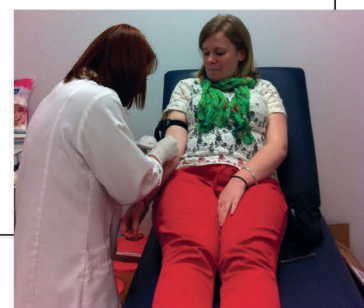
- A Controlled Stress Rheometer
- Ideally suited for viscoelastic characterisation of a wide range of materials including paints, inks, polymers & bio systems (e.g. blood)
- Temperature control -40°C to 200°C ($\pm 0.1^\circ\text{C}$)

ARES-G2 RHEOMETER

- A Controlled Strain Rheometer
- Offers unique separate motor and transducer technology for the purest rheological measurements.
- Capable of rapid heating and cooling of samples from 150°C to 600°C
- Suitable for viscoelastic characterisation of strain sensitive materials (e.g. gels, biopolymers)

BENEFITS

- Accurate, easy to use and reliable with expanded test modes
- Accurately replicate stress and strain relevant to materials, performing several controlled experiments with little sample volume required
- Capable of measuring stress independently of the applied shear deformation for the purest rheological measurements especially on sensitive materials
- Improved production process and reduced waste of products
- Accurately characterises materials including long term stability



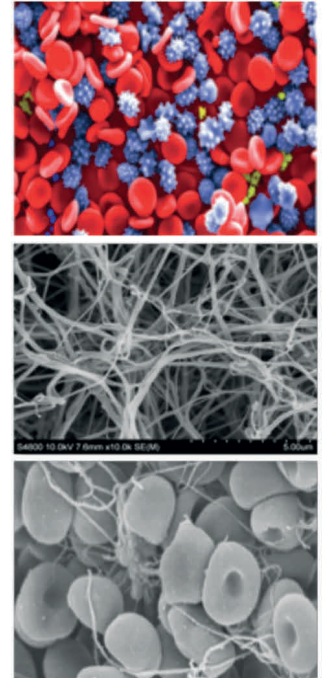
CASE STUDY

At the centre, Rheometers are used to determine clotting characteristics of blood. Understanding the factors affecting blood clotting is of vital importance for future medical device development. The rheometers can mimic blood flow in blood vessels.

COMPARISON OF THE INVERTEBRATE THROMBI WITH HUMAN BLOOD

Working with Swansea University's biology department, the centre investigated the rheological properties of invertebrate blood clots (e.g. Cockroach, crab, starfish) and the clot formation, comparing the invertebrate thrombi to human blood. The results showed that cockroaches' blood increased the clotting stiffness and would therefore be suitable for use as a therapeutic agent.

The Rheology laboratory also works closely with colleagues at the NISCHR Haemostasis Biomedical Research Unit at Morriston Hospital. Analysis of rheological and microscopic data (SEM and LSCM) obtained during the clotting process can provide a quantitative measure of clot microstructure, which in turn can form a haemorheometrical tool for disease monitoring and screening.



PRODUCTION OF BLOOD OXYGENATORS

(Including oxygenators simulating lungs/respiratory aid and deoxygenators simulating living breathing). The centre used blood from human volunteers in order to provide a controlled reproducible environment for evaluating enhancements in supporting sufferers of lung disease whilst reducing animal trials to an absolute minimum.

GELATIN CHARACTERISATION STUDY

EuroCaps is a company that offers a full range of gelatin and non-gelatin softgel capsules. They are leaders in Oil encapsulation and have expertise in Capsule Manufacturing. The Rheology team used the sophisticated rheometers to characterise the softgels capsulation in order to investigate their shelf life and quality control of raw and new materials, leading to better quality products.

| AREAS OF INTEREST | APPLICATIONS |
|-------------------|--|
| RAW MATERIALS | <ul style="list-style-type: none"> • Raw Material rheology and viscosity specification |
| R & D SERVICES | <ul style="list-style-type: none"> • Next generation product development • R&D/QC rheological test methods • Product rheological characterisation • Rheology stability/shelf-life studies • Validation of rheology test methods |
| LIQUIDS/MATERIALS | <ul style="list-style-type: none"> • Sol gels • Polymers and biopolymers • Blood, collagen, plasma and body fluids • Food & Cosmetics • Oils, sludges, • Paints & inks |