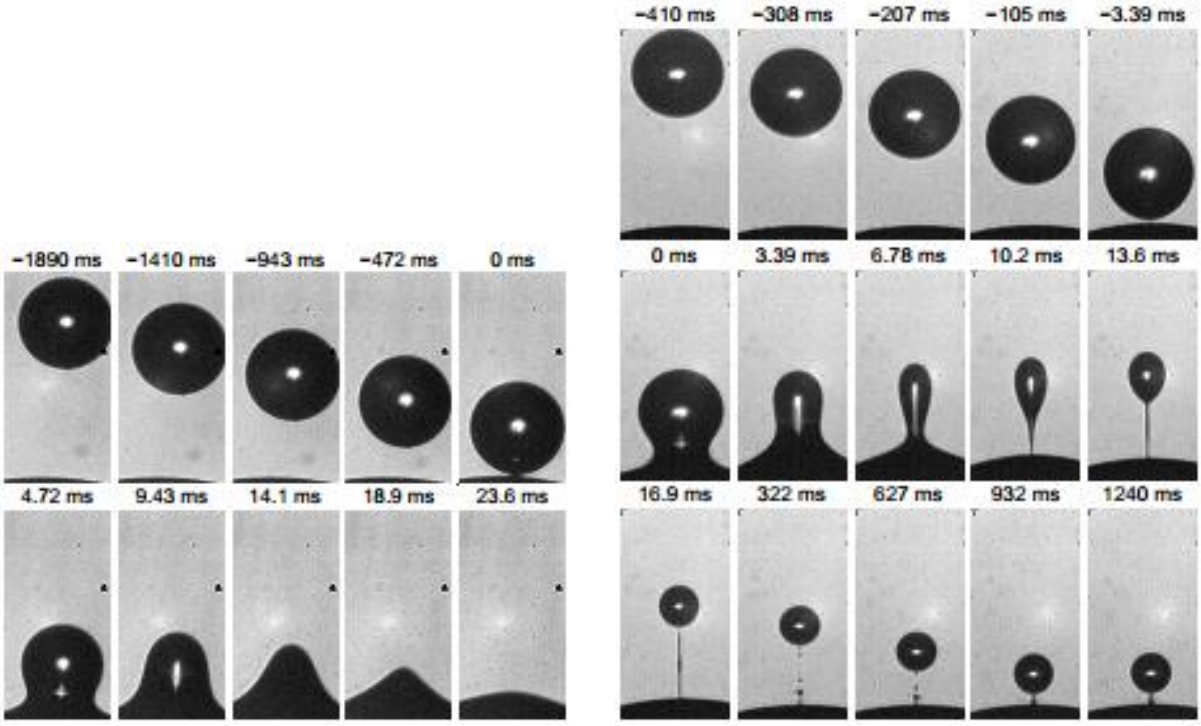
Student project / Master's thesis at SINTEF Energy Research, Department of Electric Power Technology

SINTEF Energy Research is a research institute located in Trondheim, Norway. It collaborates closely with the Norwegian University of Science and Technology (NTNU), educating candidates on MSc and PhD level. The Department of Electric Power Technology has advanced electric and materials technology laboratory and is engaged in contract research within electric power technology, analyses, testing and development of equipment.

Experimental investigation of water droplets in oil subjected to an electric field



Sequence showing a coalescence and partial coalescence of a water drop in crude oil under an applied electrical field. Diameter 0.70 mm, applied electrical field 750 V/cm (left images sequence) and 1330 V/cm (right image sequence). (Photos: SINTEF)

Background

The work will be part of the SINTEF project "Fundamental understanding of electrocoalescence in heavy crude oils". The background for the project is that electric fields enhance the separation of oil and water, since water droplets in oil subject to an electric field tend to coalesce more readily. However, all the details in the mechanisms are not well understood. In particular, the influence of interface-active agents (surfactants) and other components at the oil-water interface needs further investigation. This requires a combined experimental and modelling effort focusing on relevant fundamental phenomena.

This student project / master's thesis is within the experimental activity. Using high-speed camera techniques, the response of droplets to an electric field can be captured. These techniques can also be applied to study the shape and speed of falling droplets, thus inferring the influence of surfactants. The droplet dynamics during coalescence will also be studied.

The work will contribute to the further development of already established experimental facilities. The data produced will contribute to an increased physical understanding of the involved phenomena through dimensional analysis and comparison with model predictions.

Tasks

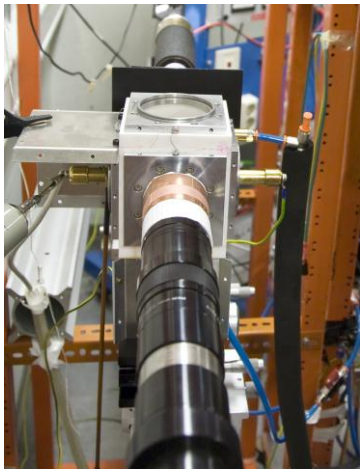
- Use a high-speed camera to capture the dynamics of water droplets in model oils, with and without surfactant, and also in crude oils, subject to an electric field. In particular
    - falling droplets
    - a small droplet coalescing with a large droplet

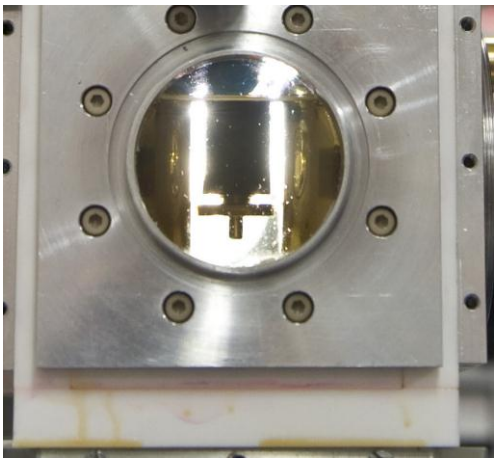
  will be investigated.
- Conduct systematic experiments varying parameters such as droplet size, the amount of surfactant present in the model oil, the type of oil, and the temperature.
- Log and sort experimental data.
- Analyse the experimental data with dimensional analysis.
- Write a report/Master's thesis in English.

The emphasis on the various points above can be somewhat adjusted according to the interests of the student.

Prerequisites

- Interest in experimental two-phase flow
- Ability to work of thoroughly and systematically in the laboratory
- Interest in fluid dynamics and electrostatics
- Please include an academic transcript with your application





Exampel of test setup (left) and test cell with crude oil (right).(Photos: SINTEF/Thor Nielsen)

Contact persons

Lars Lundgaard (lars.lundgaard@sintef.no) tlf 930 07 018
Gunnar Berg (Gunnar.berg@sintef.no), tlf 92 45 81 11
Svend T. Munkejord (svend.t.munkejord@sintef.no), tlf: 73593897