



Masterclass Hands-on Lab Course on Rheology

Advanced Course

1. COURSE DETAILS

Location: at iPrint in Marly, Switzerland

Participation Fee: EUR 1,850

2. TWO-DAY PROGRAM

This course covers all aspects of rheology relevant to inkjet printing and at timescale relevant to inkjet printing. We discuss shear (low, mid and high), high frequency, and extensional rheology. We also look at the influence of ink components on ink rheology and its influence on the jetting behaviour. We explore ways to optimise inks rheological properties to control misting, satellites, and achieve reliable jetting.

3. ADMISSION REQUIREMENTS

The course is open to all participants who have:

- completed the foundation course in inkjet engineering and inkjet chemistry at the iPrint Institute and/or
- basic understanding of rheology

4. BACKGROUND

Rheology is the study of the deformation and flow of matter under the influence of an applied stress/strain. Flow/deformation behaviour of complex fluid like ink cannot be simply described by classical fluid mechanics or elasticity as such fluids are termed non-Newtonian fluids. Recent innovative ideas and technological breakthroughs in printhead design and ink formulation have extended inkjet technology to newly emerging markets and applications, such as display fabrication, control-release drug delivery, anti-counterfeit and 3D printing. Fundamental understanding of ink chemistry, formulations and influence of individual components and ink as a whole on dynamic flow behaviour in-channel, nozzle, in-flight and on-substrate during printing is vital to control print quality (drop ejection characteristic, reliability) and further advances in the capability of inkjet technology.

5. ADVANCED RHEOLOGY

Advanced rheology is targeted for ink formulators and chemists providing some insight into the (i) flow behaviour of Newtonian and non-Newtonian fluids and (ii) rheometry tools (off-the-shelf and prototype) to characterise high shear, extensional and high frequency rheology of low viscosity fluids.

In this Masterclass we review an overview of inkjet inks, and how and where individual ink components influence the jetting behaviour during printing. Physical properties alone are no guide to ink performance. Small variations in ink viscoelasticity influences upstream flow dynamics and jet break-up mechanism downstream. We will present techniques capable of quantifying complex fluid rheology of low viscosity inkjet inks at conditions similar to those during printing, which have not been possible until recently.



We will discuss and demonstrate that jetting behaviour of weak viscoelastic inkjet fluid during printing can be linked with appropriate measurement of inkjet fluid rheology. The bulk viscosity alone is no guide to print performance. The size of the main drop, ligament length and jetting speed can be correlated with other rheological properties.

These techniques, used prior to filling print heads, would provide useful tools to differentiate between identical inks that have similar bulk properties but show different jetting behaviour during printing. This is often the case, where ink batch variations may result in different jetting behaviour and issues with the ink printability. These tools will aid ink formulators to quickly shortlist their inks.

6. DR. TRI TULADHAR

The Masterclass is led by Dr. Tri Tuladhar. Tri Tuladhar graduated in Chemical Engineering from RMIT, Australia and holds a PhD in Chemical Engineering from the University of Cambridge, UK. He has over 20 years' experience in R&D in academia and industry. Over the last 12 years, he has focussed on complex rheology of inkjet printing ink and developed novel techniques to link fluid rheology to jetting behaviour.