SUPPORTING INFORMATION

Independent Control of Drop Size and Velocity in Microfluidic Flow-Focusing Generators Using Variable Temperature and Flow Rate

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Abstract. This supporting information contains the variation of viscosity and interfacial tension (with water) as a function of temperature for the four liquids we used as the continuous phase: (i) light mineral oil (Sigma-Aldrich, US catalog part number 330779), (ii) Dynalene SF (Dynalene Inc., trademarked bath fluid mixture made from alkylated aromatic hydrocarbon oils), (iii) perfluoroperhydrophenanthrene (PFP, Alfa Aesar US catalog part number L17370), and (iv) a mixture of 98% v/v perfluoroperhydrophenanthrene with 2% v/v perfluorooctanol (PFO, Sigma Aldrich US catalog part number 370533). PFO is a PFP-soluble and water-insoluble surfactant.

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Figure S-1. Variation of viscosity with temperature for the liquids used in this work. We either used manufacturer specifications, or viscosity measurements using a TA Instruments model AR-G2 viscometer in a cone/plate geometry (20mm diameter and 2° angle) at constant shear profile. The error bars represent the accuracy of the measurement of viscosity and temperature. Whenever possible, we used manufacturer supplied data instead of our own measurements, because of large uncertainity in temperature measurement. The temperature measurement uncertainity was caused by the difference in temperature between the viscometer plates (only the temperature of the bottom plate is controlled in this type of viscometer); this uncertainty was especially large in the case of PFP which has a very low thermal conductivity (~0.07 W/m·K). For mineral oil and Dynalene SF the agreement between measurements and manufacturer data was acceptable and we show both sets of data here. The viscosity of the PFP-PFO mixture, not shown here, is equal to the viscosity of PFP within the uncertainity of viscometer measurements. For each liquid we show the fitting function that we used to extract the viscosity at intermediate temperature.

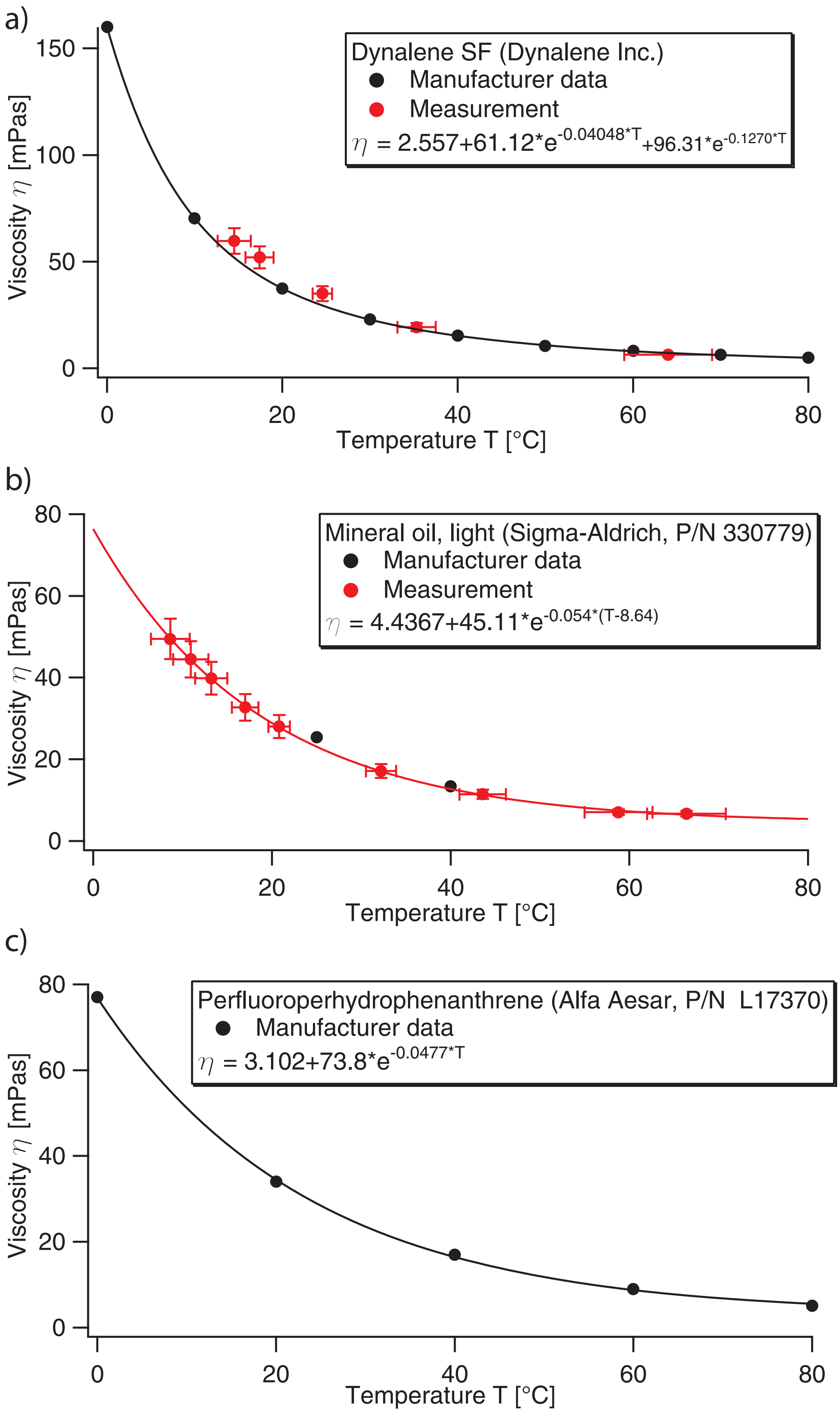
a)
Dynalene SF (Dynalene Inc.)
Manufacturer data
Measurement
η = 2.557+61.12*e^-0.04048*T+96.31*e^-0.1270*T
Viscosity η [mPas]
150
100
50
0
0
20
40
60
80
Temperature T [°C]
b)
Mineral oil, light (Sigma-Aldrich, P/N 330779)
Manufacturer data
Measurement
η = 4.4367+45.11*e^-0.054*(T-8.64)
Viscosity η [mPas]
80
60
40
20
0
0
20
40
60
80
Temperature T [°C]
c)
Perfluoroperhydrophenanthrene (Alfa Aesar, P/N L17370)
Manufacturer data
η = 3.102+73.8*e^-0.0477*T
Viscosity η [mPas]
80
60
40
20
0
0
20
40
60
80
Temperature T [°C]

Figure S-2: Variation of surface tension with temperature for the interface between water and the continuous phase liquids used in this work. We measured surface tensions by the pendant drop method using a Rame-Hart model number 500-F1 advanced goniometer. The error bars represent the statistical uncertainty of the surface tension measurement, and the accuracy of the temperature measurement. For each liquid we show the linear fitting function that we used to extract the surface tension at intermediate temperatures.