Summary of Deliverable D1.1: Measurements for fluid properties of fuels with and without additives

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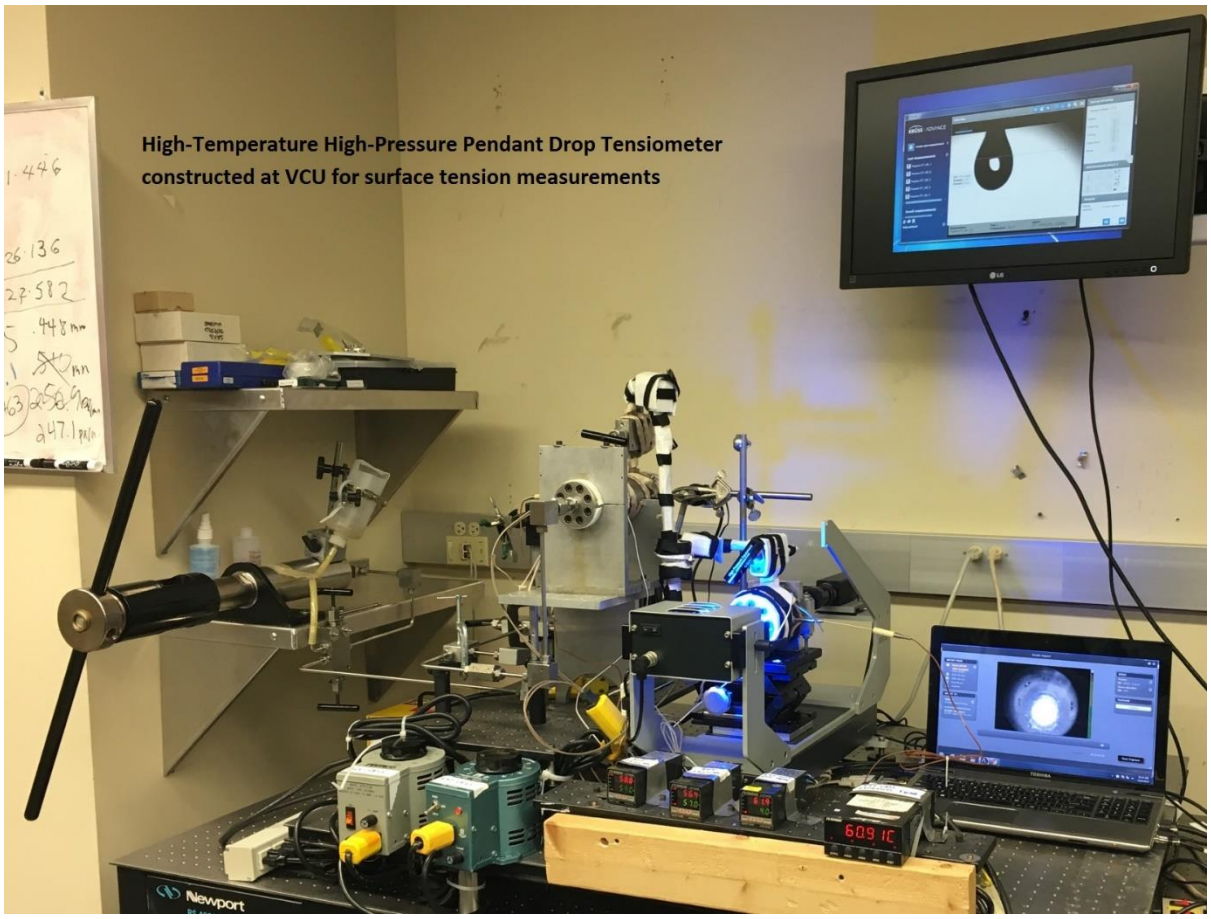

Significant progress has been made towards completion of the objectives for Deliverable 1.1, despite the late recruitment of ESR1 and the experimental challenges associated with development of experimental apparatus for measurement of fluid properties at extreme conditions of pressure and temperature. Within the limited duration, many significant objectives have been accomplished.

For density & viscosity measurements, a one-of-a-kind rolling-ball viscometer and densimeter has been commissioned and tested to the maximum conditions specified in the IPPAD project, 260ºC and 300 MPa. Viscosity measurements for a diesel surrogate component – toluene have been conducted at an expanded uncertainty of 4%. The measurements are in excellent agreement with 18 available primary literature resources. The majority of the data is within the accumulated experimental uncertainty of the data obtained with this apparatus. Results from the measurements have been shared with members of the IPPAD consortium at the meeting at Rueil-Malmaison in November 2016.

For Interfacial Tension (IFT) Measurements, a rig, based on the pendant drop method has been built and is about 80% complete. The rig has been tested at ambient conditions and the IFT of several hydrocarbons has been measured to within ± 1% and those data match available literature data to within ±2%. The IFT rig has been tested successfully to pressures up to 5 MPa using a make-shift IFT cell. A newly designed and constructed IFT cell has also been pressure tested to 300 MPa. We anticipate testing the entire IFT rig, with the new IFT cell, to 260ºC and 300 MPa within the next few weeks. Measurements for a diesel surrogate – n-dodecane have been conducted and the most of the measurements are within ± 2% of the data available in literature.

For measurement of thermal properties, the transient plane source (TPS) method has been identified as it can be readily adapted to high pressures and the analysis of the measurements is straightforward. The TPS approach will allow thermal property measurements including heat capacity, thermal diffusivity, and thermal conductivity. Once the design is finalized, the TPS setup will be developed and commissioned for high temperature, high pressure operation.