

CAMTIA

Contact Angle Measurement Tool based on Image Analysis

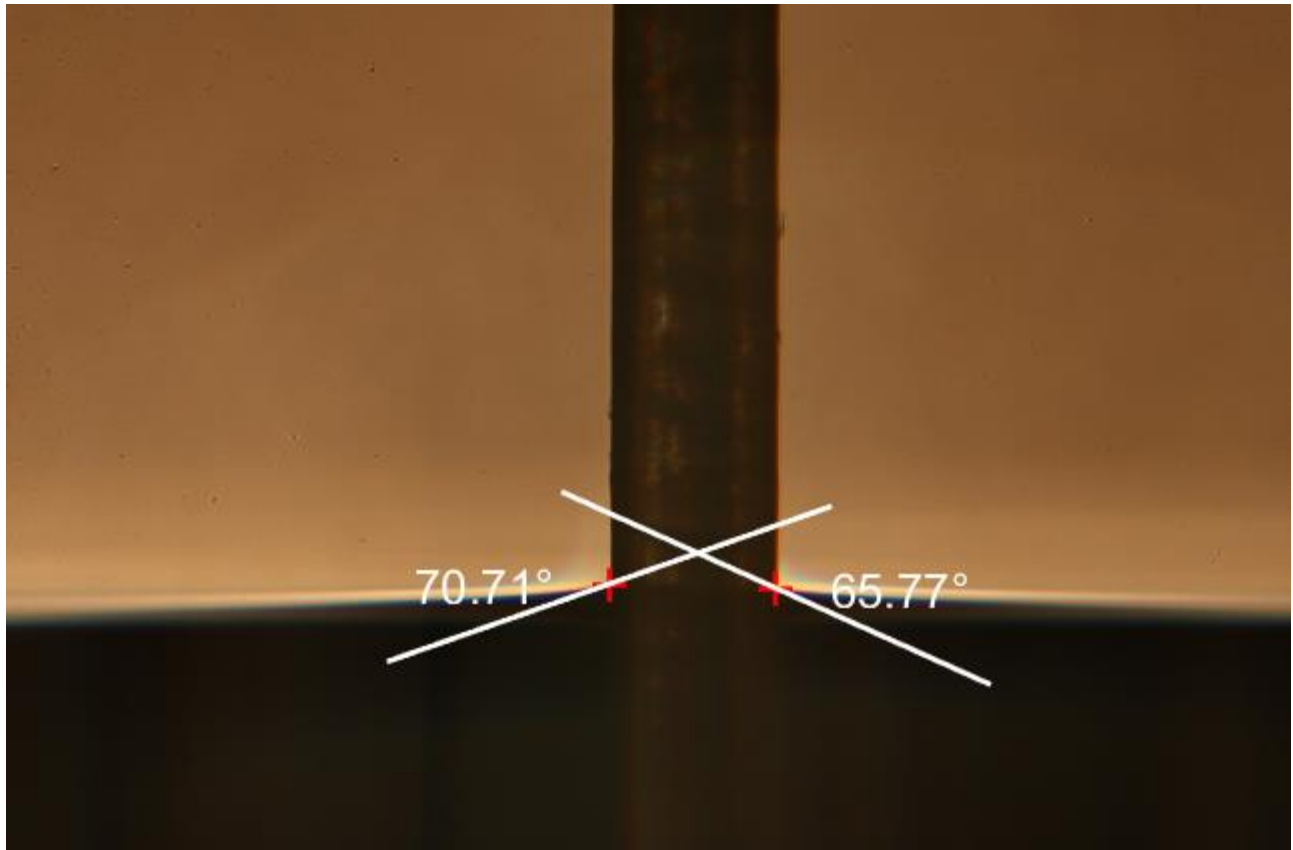
Instruction Manual

Version 2.0 (12/2016)

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Introduction

We present an open-source software CAMTIA (Contact Angle Measurement Tool based on Image Analysis) that can be used for a direct evaluation of the contact angles on sessile drops or menisci formed around partially submerged fibers. CAMTIA was developed and run in the [MATLAB environment](#). For an optimal performance it is recommended to use MATLAB R2012a or higher.

1. Program Structure

The program initiates after running the `camtia.m` file, located in the root program folder (Figure 1). Exported data (images, excel spreadsheets) can be found in the “export” folder, while folders “files” and “functions” store the program auxiliary scripts and functions, and do not need to be accessed by the user. The “images” folder must contain the images to be investigated (these can be organized in subfolders) and parameters can be set in `setParameters.m` file located in “settings” folder. The description of individual parameters is provided in the `setParameters.m` file.

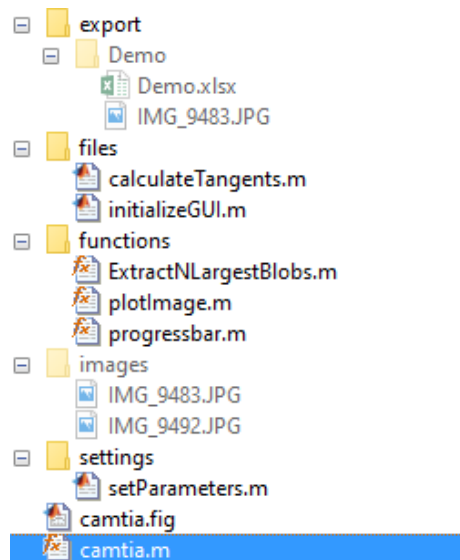


Figure 1: Structure of the program folders and files.

2. Program structure

The program structure is very simple (see Figure 2). After running the `camtia.m` file the user must load images and consequently is asked about a name of the project – this project name is used for naming subfolders and files when exporting images / data. After assigning a project name, the user is prompted to choose between fiber wettability test or sessile drop test, because these set-ups require different algorithms (see Figure 2).

B/W threshold (black-and-white threshold for binarization of the images) can be set after pressing the B/W threshold toggle button by using the slider (see Figure 4). This threshold should be set only if the results are not satisfactory. If so, the contours of the liquid level and the submerged sample should be clearly distinguished.

The arrow-buttons in the “Move tangents” section can be used to adjust the computed tangents manually.

“Export image” and “Export results” buttons are used to export images / data.

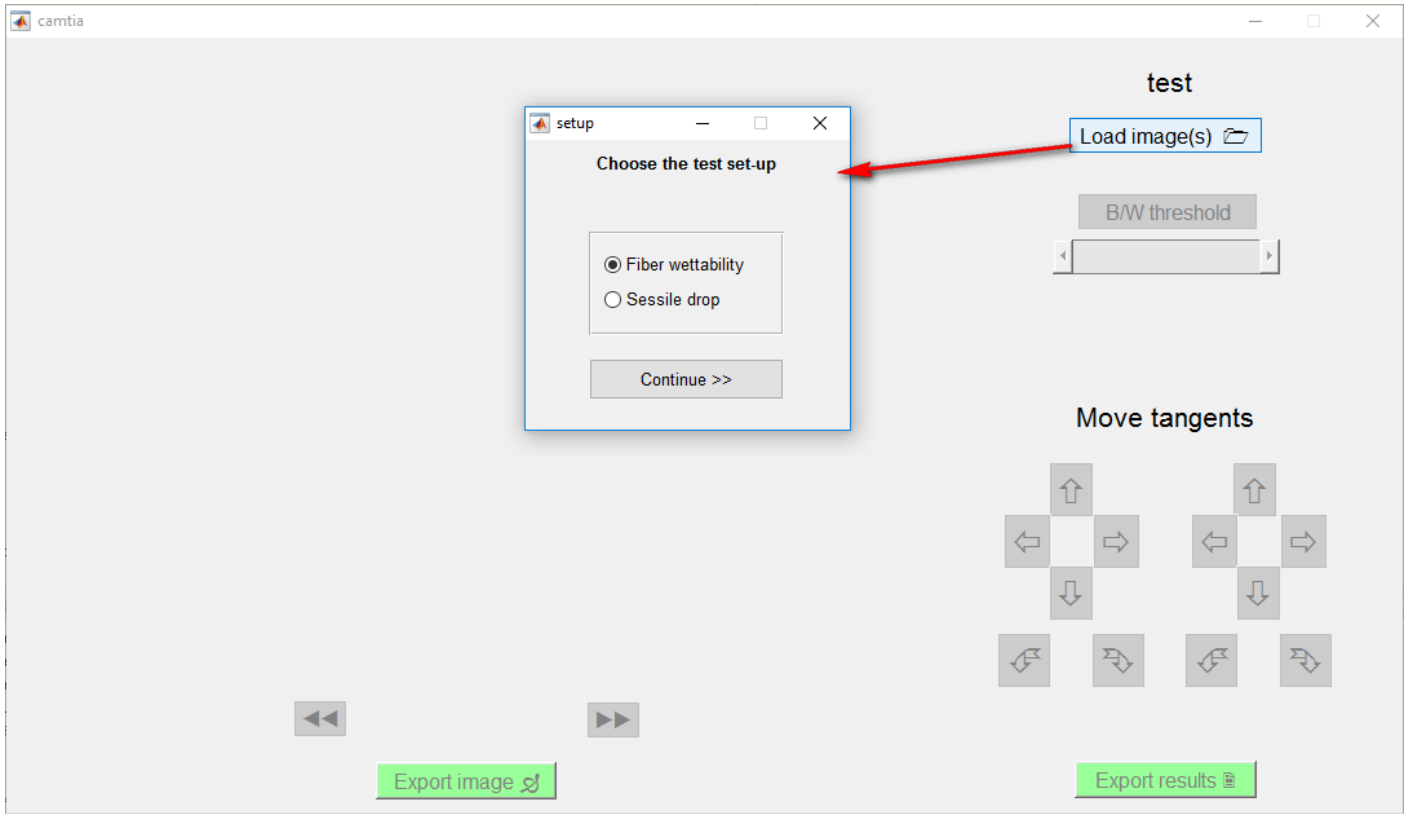


Figure 2: Set-up of the experiment.

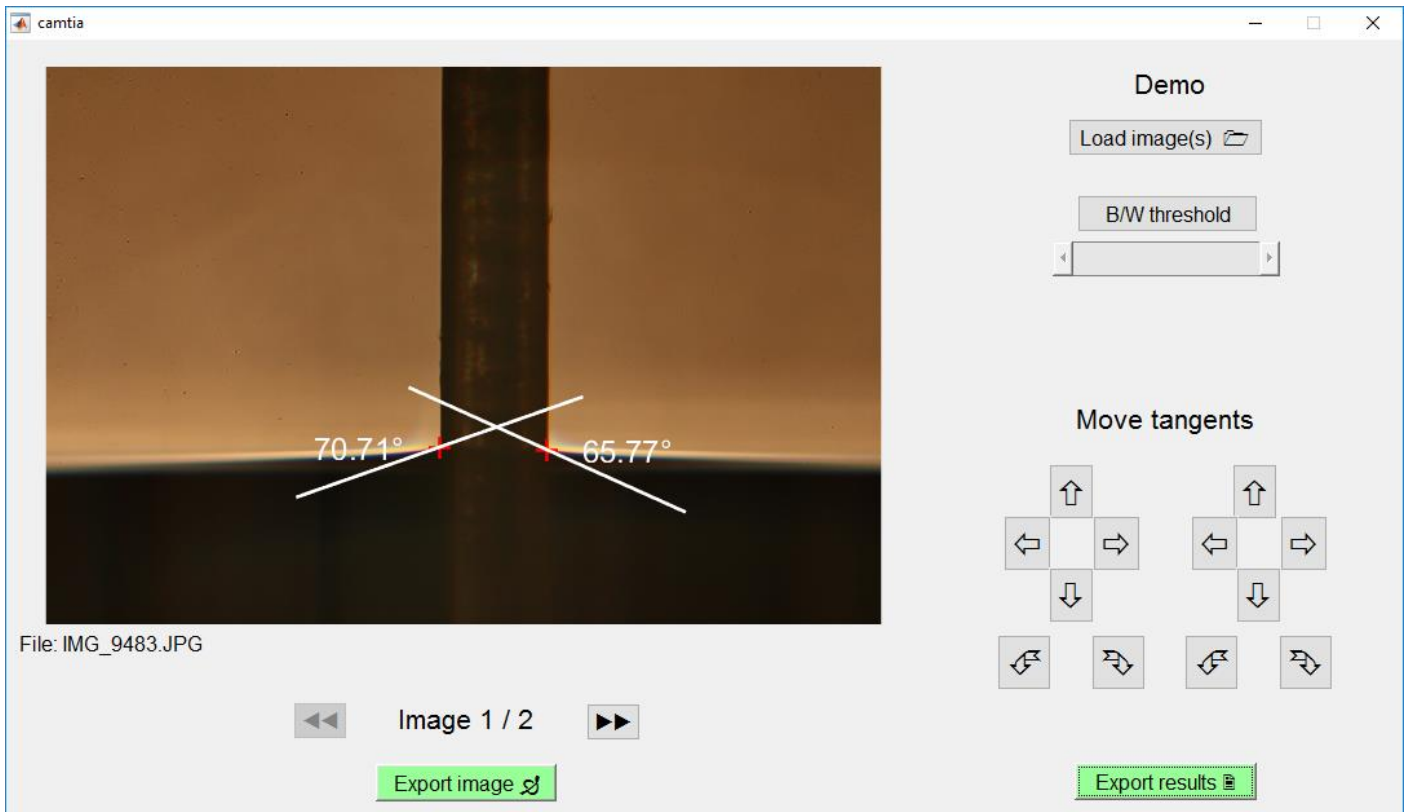


Figure 3: Graphical interface of the program.

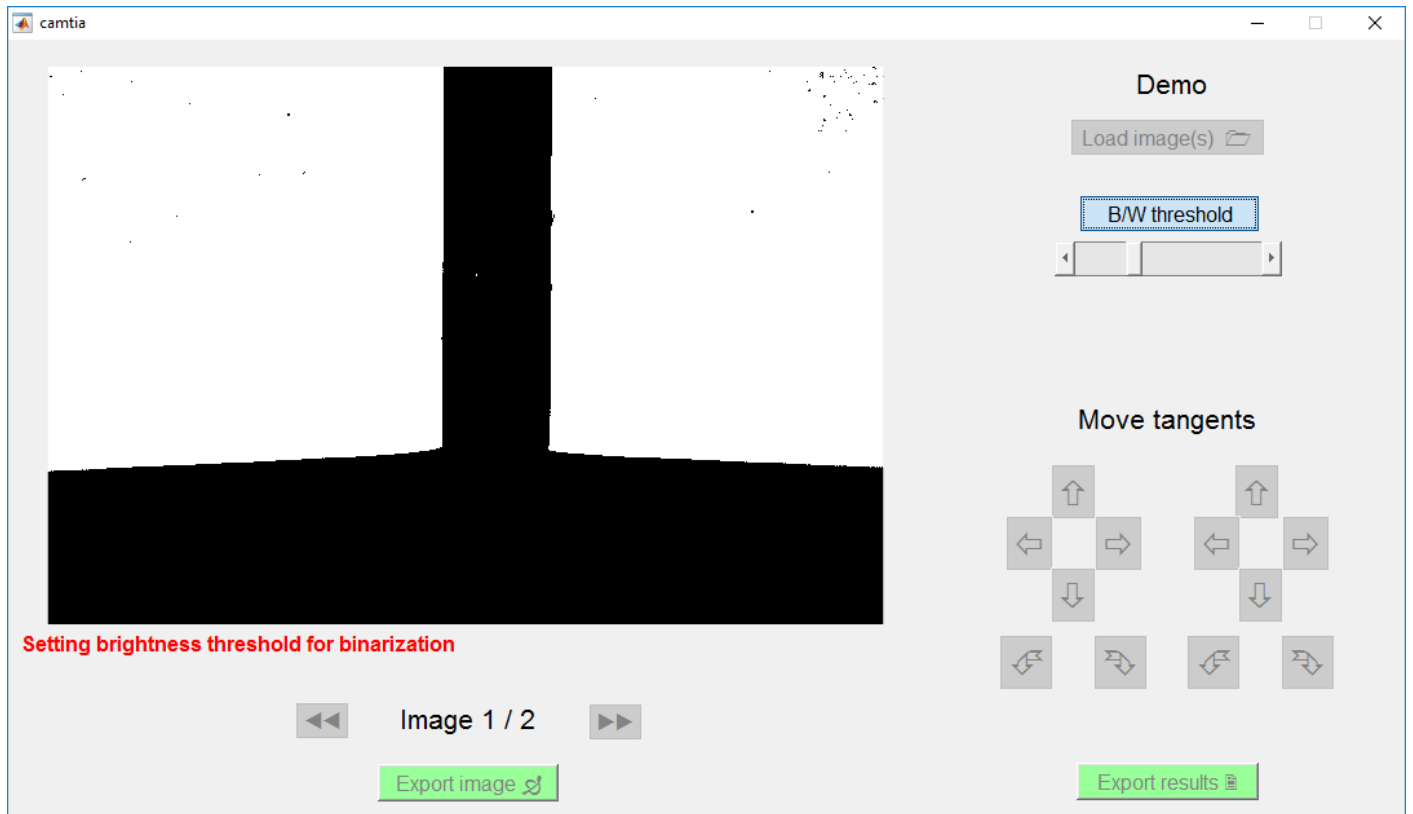
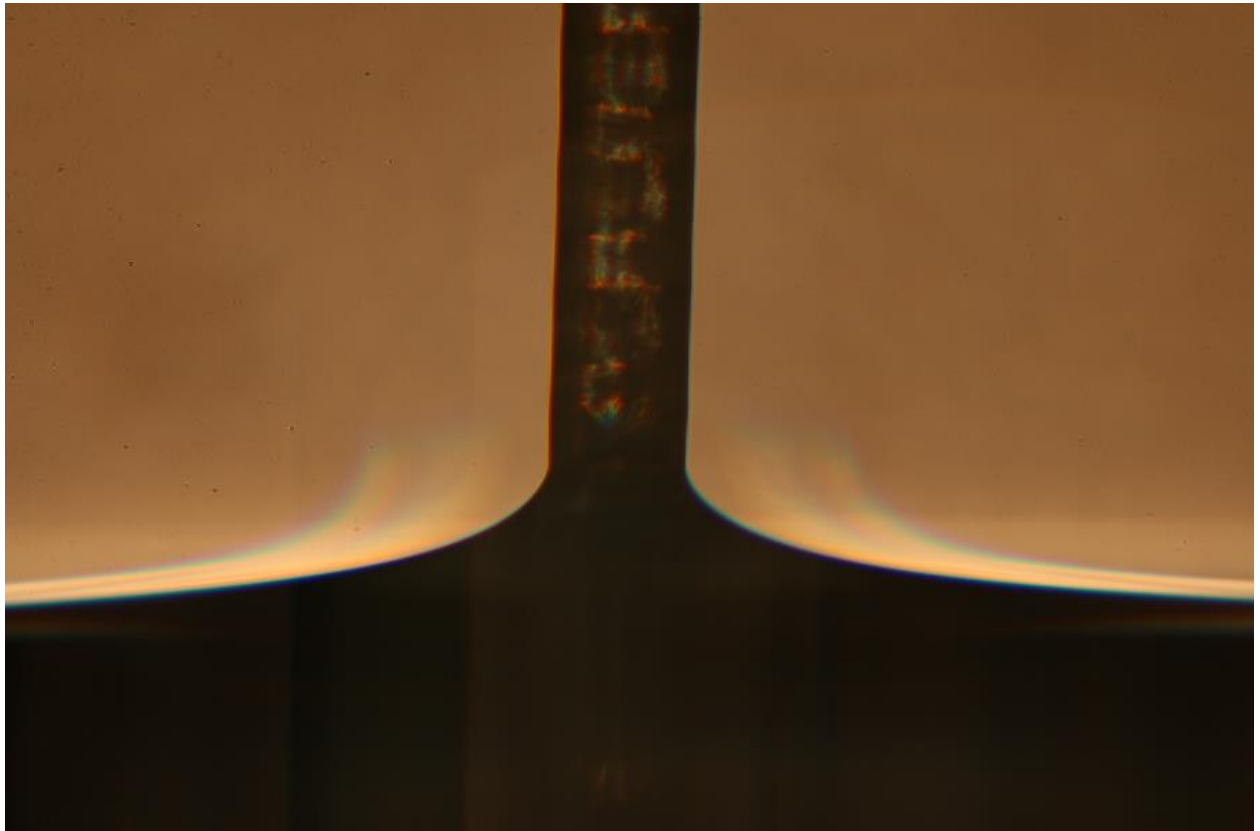


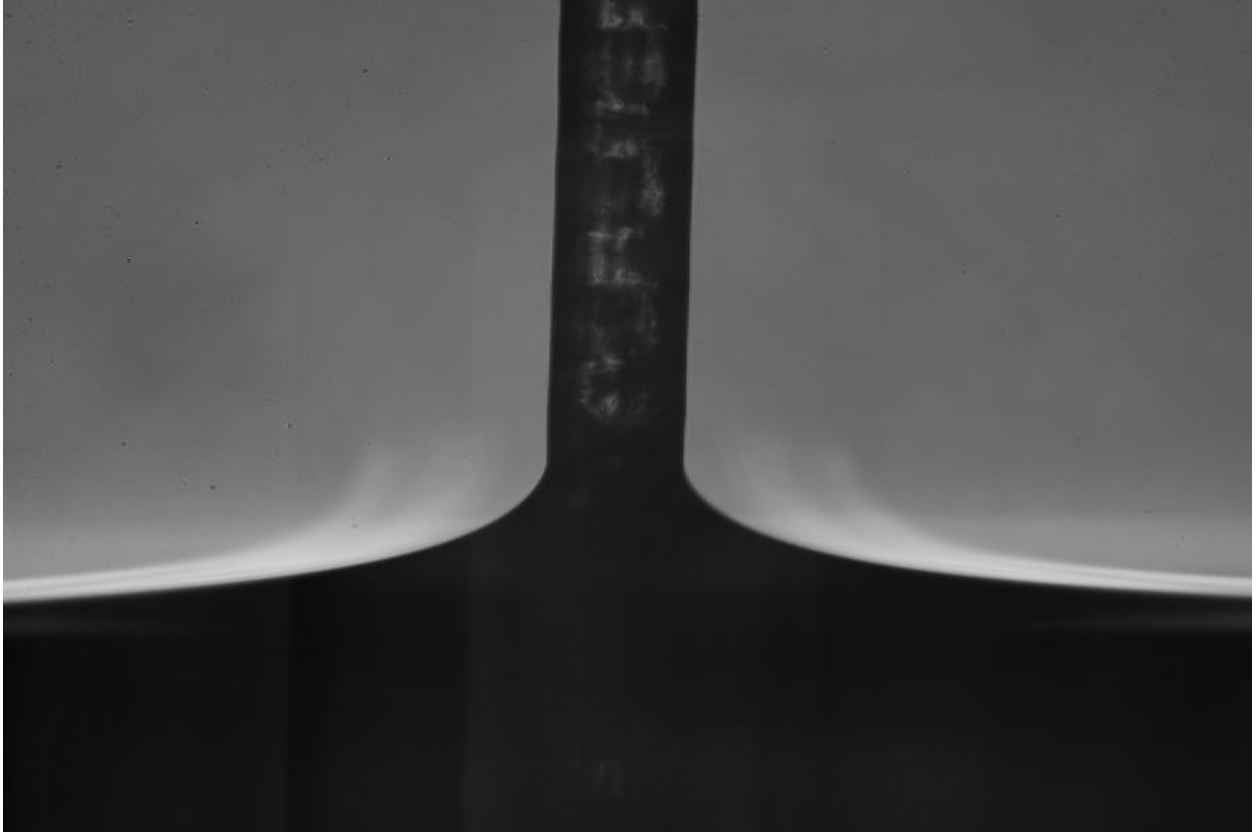
Figure 4: Setting B/W threshold.

3. Program flow

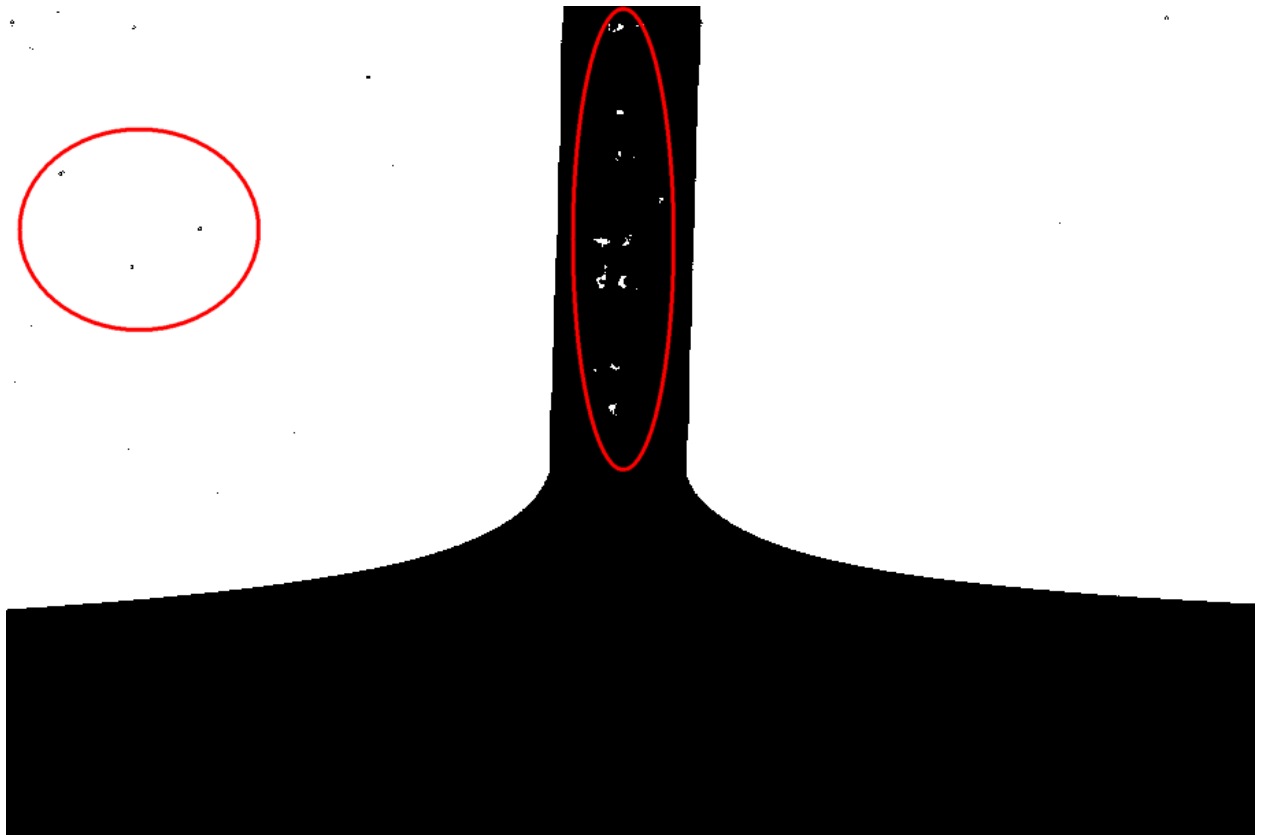
1. The calculation of contact angles is carried out on color images (e.g. jpeg, png):



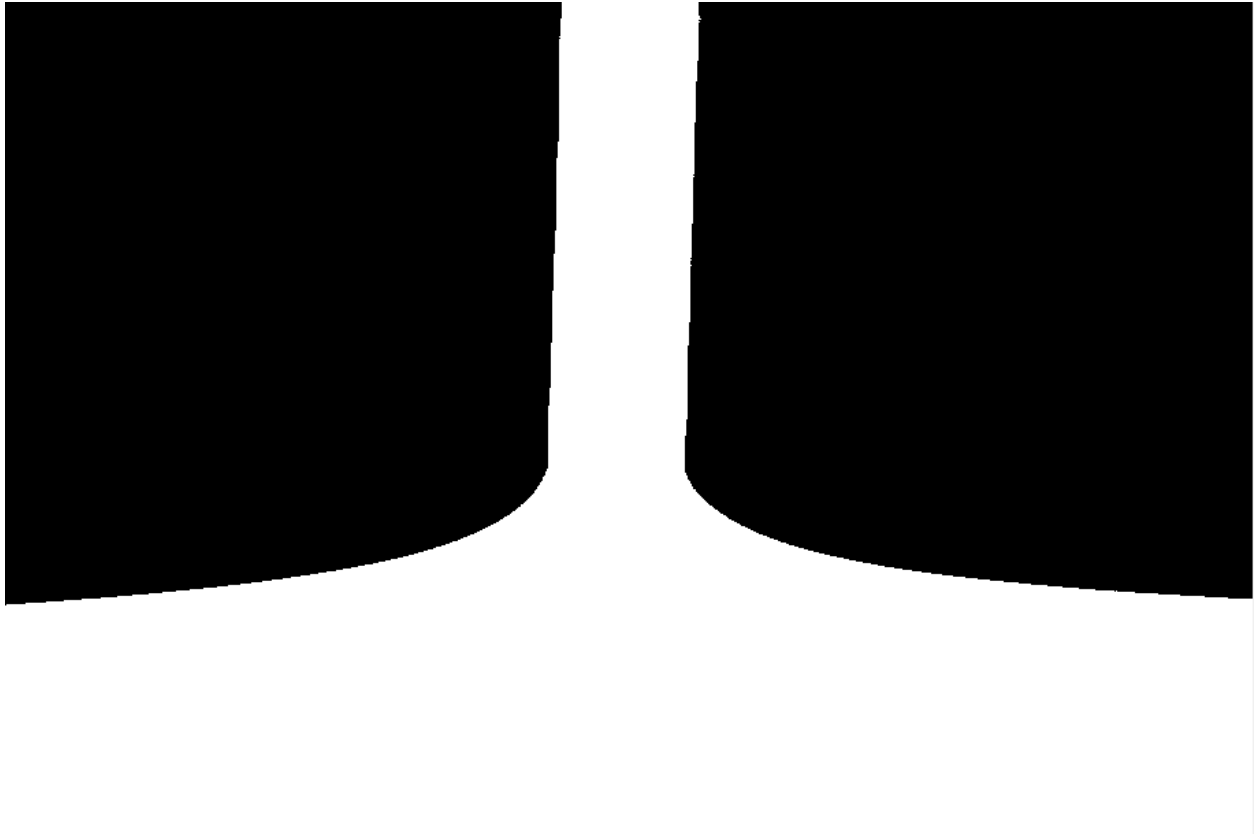
2. The images are converted to gray-scale:



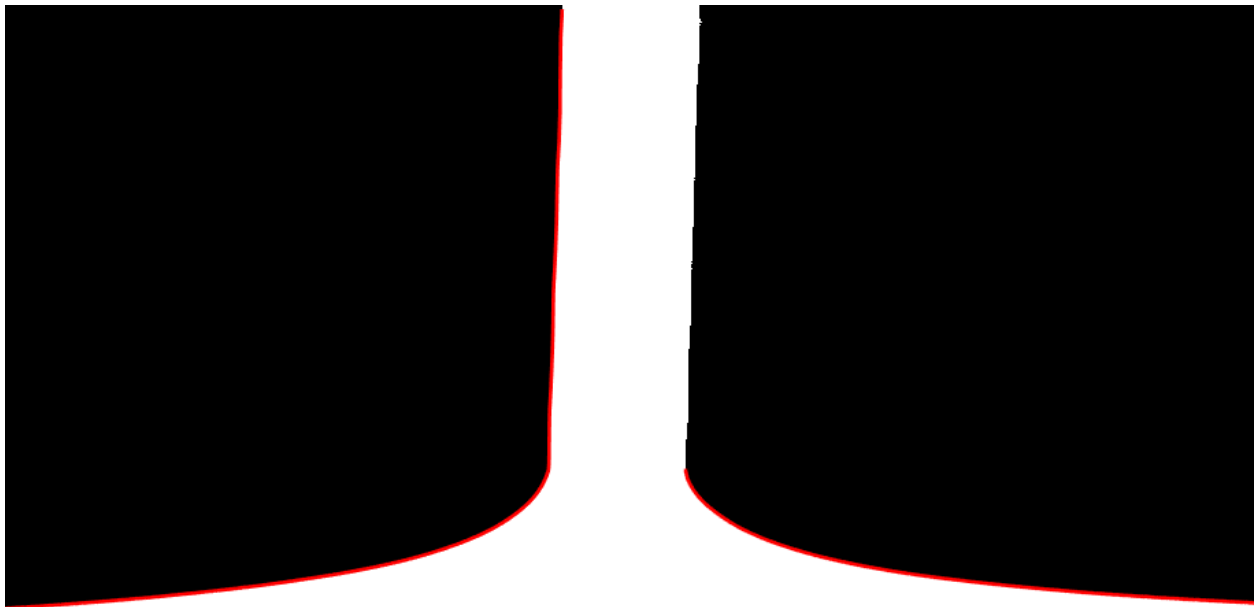
3. Binary image is created, however, some redundant spots have to be removed:



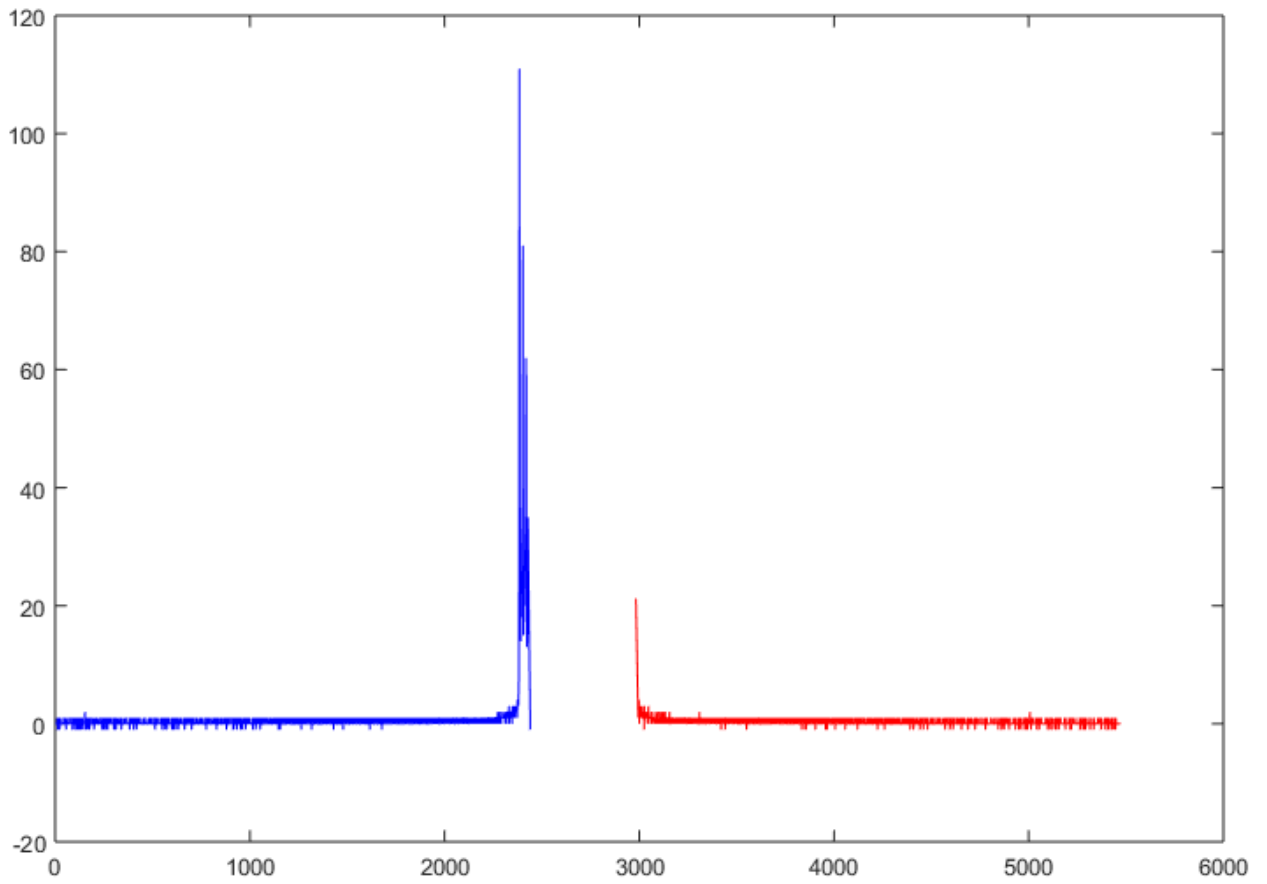
4. The binary image is cleared and the edges of the interfaces are slightly smoothed:



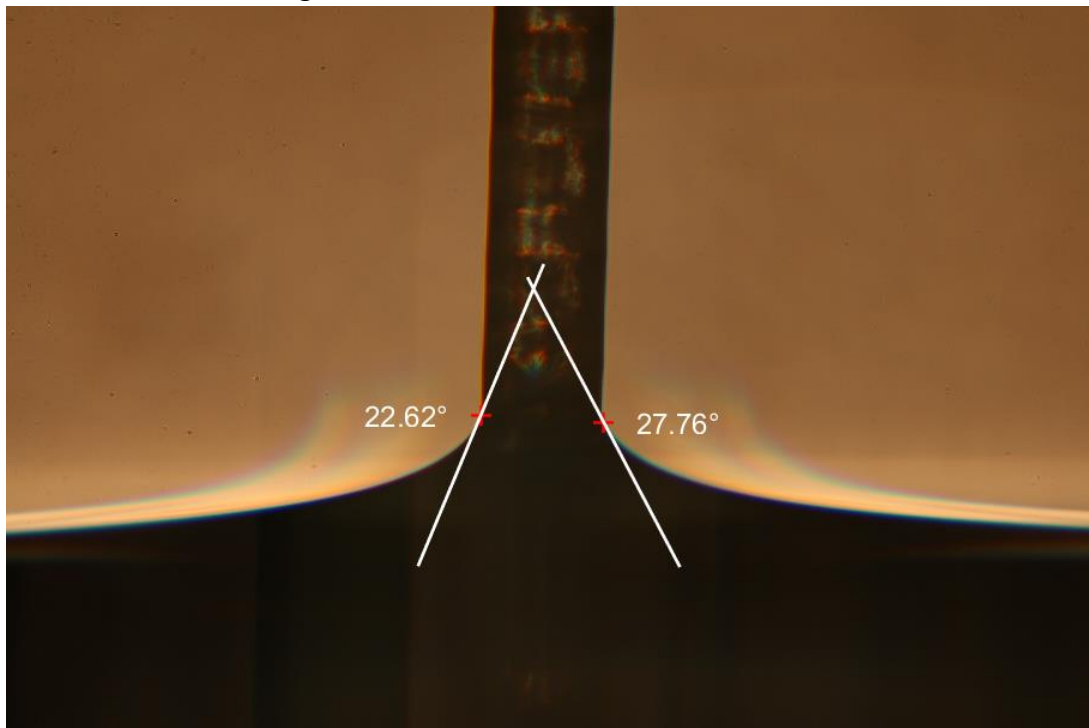
5. Boundary curves are found:

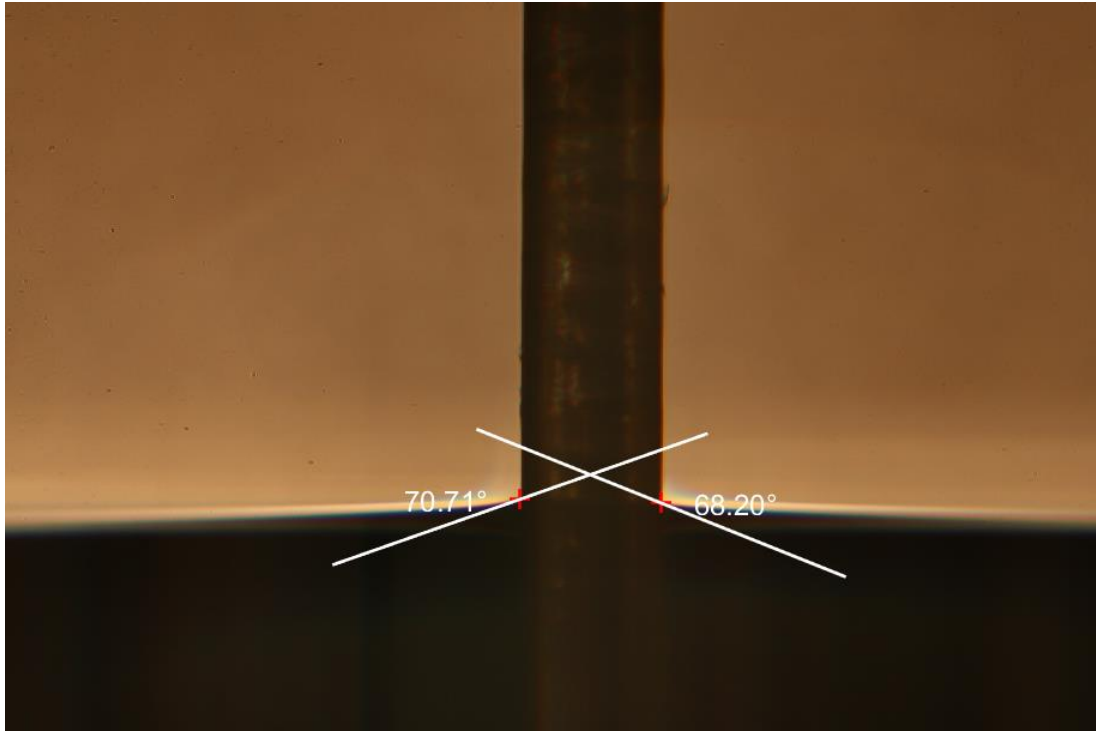


6. Local differences for the curves are calculated, indicating the rate of slope change:

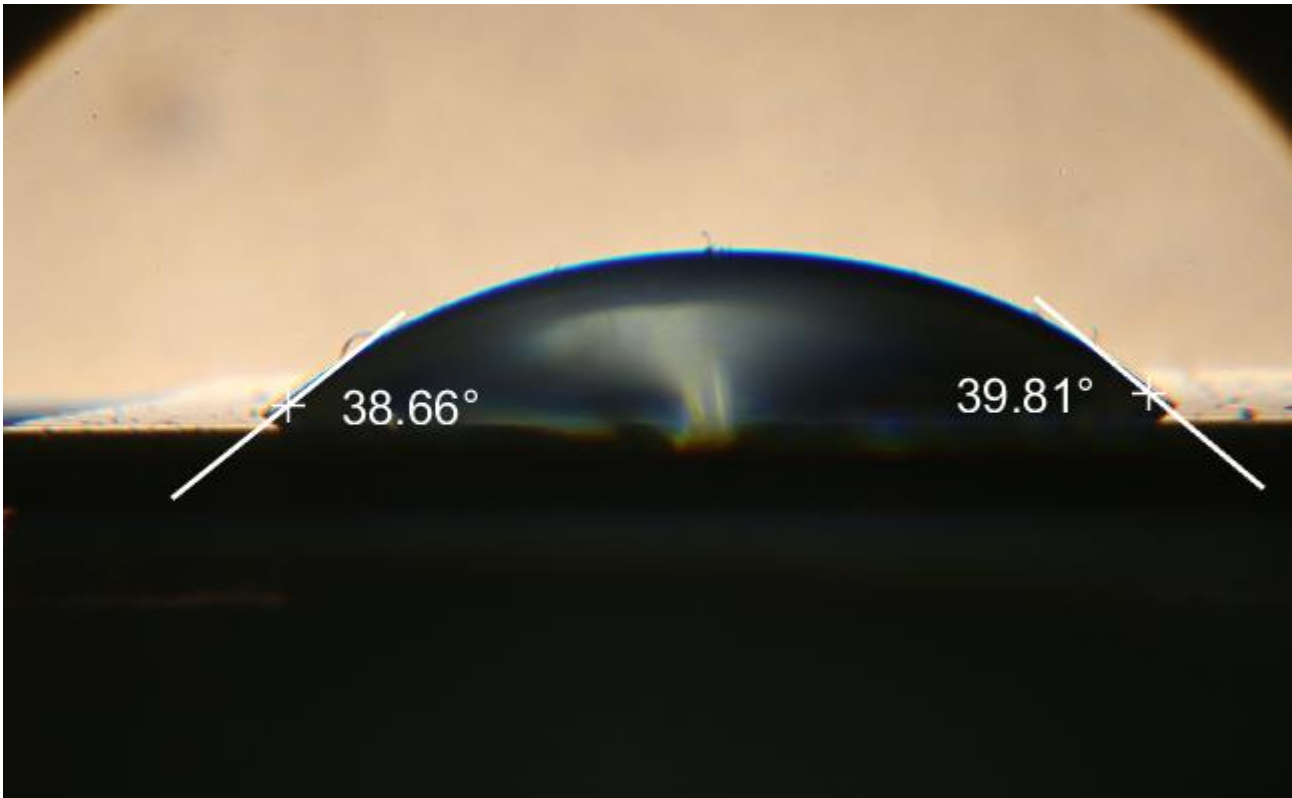


7. Points of interest and tangents are found:

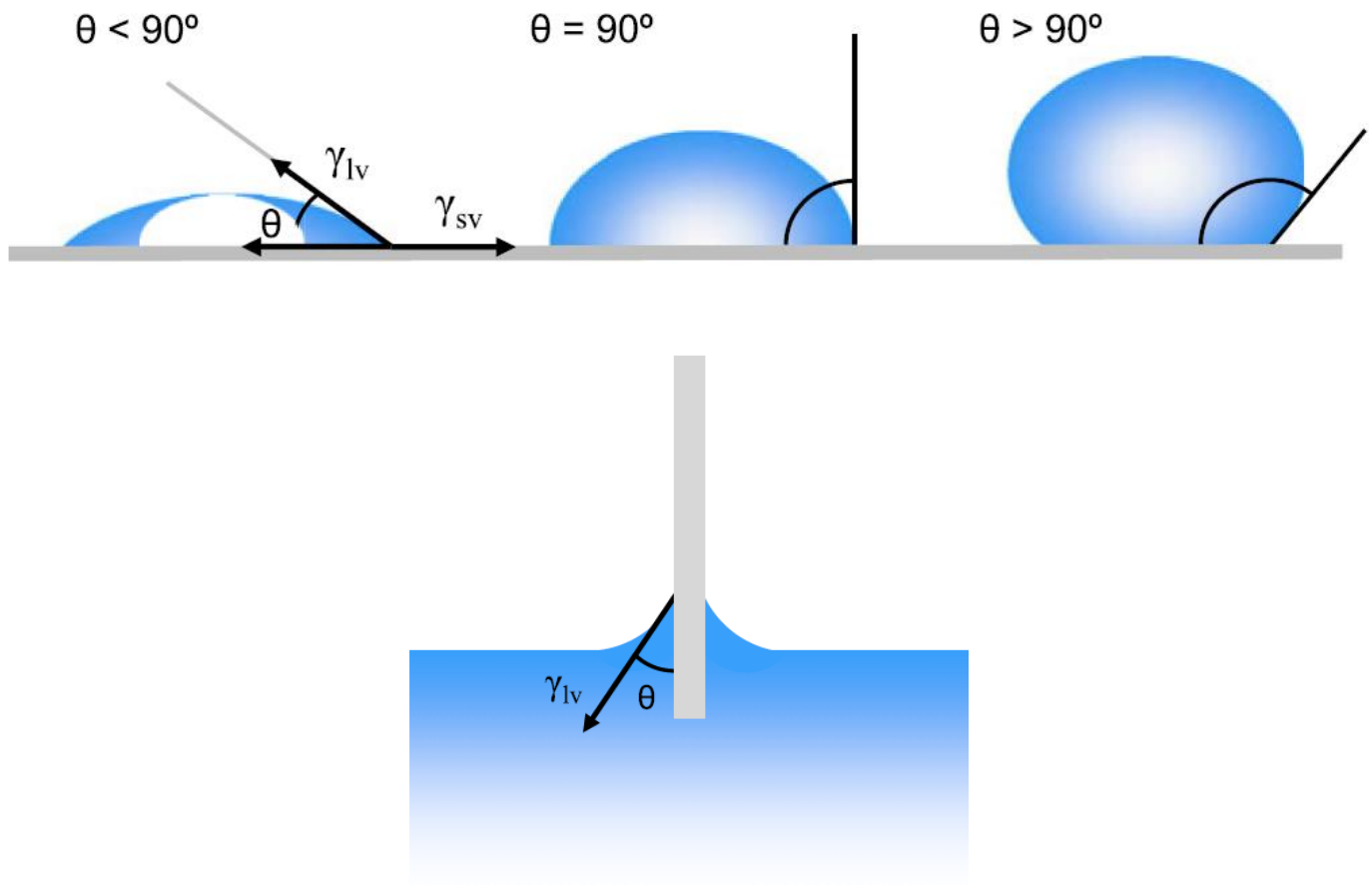




The program, as indicated by the prompt in Figure 2, is not limited to assessment of fiber wettability only, but sessile drop test to investigate the wettability of surfaces can be also assessed, as demonstrated by the next figure:



For both experimental set-ups, i.e. fiber wettability and sessile drop test, there is an established convention how to measure the angles, see the following figures:



Acknowledgement

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