

## Dynamic Shear Rheometer (DSR)

### Step-by-step procedure for frequency sweep tests

- 1 Switch on the equipment (both the DSR device and the apparatus next to it) and wait for the OK sign.
- 2 Run the software RHEOPLUS/32 V2.66.
- 3 On the upper panel choose the DSR button "Device: MCR500".
- 4 Push on button "Initialisation".
- 5 Check the cooling system: click *Dev-COM1* and set temperature 20°C (for 25mm plate) and 10°C (for 8mm plate), this turns on the cooling/heating system, and when cooling system runs - the orange propeller behind the rheometer is running and the sign on cooler showing the temperature).
- 6 Set the Peltier temperature as the average of the testing temperatures that are going to be used for testing for each plate geometry, normally 20° C for PP8 and 50° C for PP25.
- 7 Go to 'Configuration' and check if options "Switch off Peltier after Test" and "Switch off Temp controller after Test" are clicked in order equipment stops automatically after the test.
- 8 Set also the corresponding plate geometry PP8 or PP25.
- 9 Place the necessary bottom plate (8 mm or 25 mm) and fix it with the key.
- 10 Place the corresponding upper plate (verify sign of the apparatus and sign of the upper plate are in line) in a proper position (be sure that the upper plate does not drop off, hold it while placing) and check if it is locked.
- 11 Initialize – click "Zero Gap". Check if the inserted data for max and min gap are: for 8mm – 60mm and 2mm; for 25mm – 1 mm and 60 mm. Make sure that you have selected the right measurement system (PP25/PEH-SN13164 for the 25mm plate (used for 30°C – 80°C) and PP8/PeH-SN17147 for the 8mm (used for 0°C – 30°C); below 0°C use 4mm plate. Push the hood down and wait for 30 minutes to reach the temperature equilibrium and press again *Zero Gap* and wait until the sign becomes again green (means it is ready for testing). The initialisation and zero gap step is needed only once if you run samples with the same geometry.
- 12 Next proceed again to set "Peltier". Set temperature at 60°C independently of the plate geometry (wait until temperature reaches 60°C) and push the hood down. This step is needed before placing the sample to ensure adhesion of the samples with the plates.
- 13 Press *Lift Position (Lift Pos.)* button, put out the upper plate carefully.
- 14 Heat the upper plate in the heating plate for 1-2 minutes and then stick the corresponding sample from the silicone mould. Priorly release with your hands the sample from the mould so that can be freely attached to the plate.
- 15 Place the plate back carefully with the sample attached on it.
- 16 Press *Measuring position (Meas. Pos.)* button and push down the hood. Wait for 2 minutes to ensure the adhesion in the setting temperature of the Peltier (60° C) with both plates.
- 17 When the upper plate is in the right trimming +0.05 of the required gap position, a window will pop up. Change temperature of Peltier to 20°C for both PP8 and PP25 before you push up the hood. First, trim the sample with a hot spatula heated several times in the heated element to complete the trimming step. When you are done with the trimming inspection then press "OK" on that window.
- 18 Open the file for the new test to insert data, find the corresponding file.
- 19 Click on upper panel choose button "Window"/Measuring window (check if the test measuring temperatures correspond in that window to the test to be performed (if 25mm plate, then temperature starts from 30°C and if 8mm then from 0°C). Drag the correct template to the measuring window according to the tested temperature
- 20 Push the button in the right upper corner "Start".
- 21 In popped out window 'Start the test' name the file accordingly to the ageing state and binder.
- 22 Then press button "Start the Test Now".
- 23 When the test is done and you want to change sample, first open the *Dev-COM1* set it to 20°C (for 25mm plate) and 10°C (for 8mm plate). Then set the Peltier to 60° C to heat the sample. Wait for 15 minutes then

press *Lift Position (Lift Pos.)* button. Use paper always wearing gloves to clean the majority of the melted sample.

- 24 Clean the upper plate (possibly by removing it) and the bottom plate without removing it with paper and toluene, if another test with same geometry is going to be performed.
- 25 If you stop performing tests put out the plates clean them properly in the recylab or in the bitumen lab and place them back in their boxes.
- 26 Turn off the Peltier and the *Dev-COM1* as well as the devices' buttons.