

# Modified cellulose nanofibers thin-film as external layer for wood-based multi-layer composites

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- Cellulose nanofibers modified with 3-Aminopropyl Triethoxysilane
- Cured modified cellulose films by solvent casting and hot pressing

# Modified cellulose nanofibers thin-film as external layer for wood-based multi- layer composites

## Why?

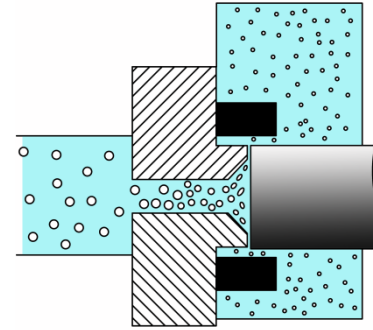
# Modified cellulose nanofibers thin-film as external layer for wood-based multi- layer composites

# What?

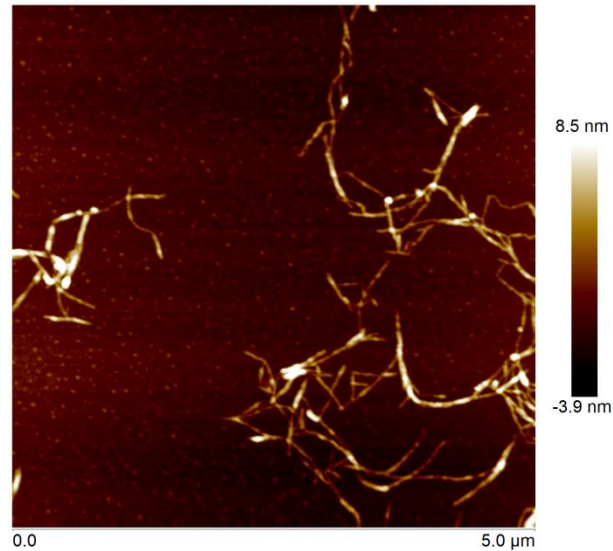
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# How?

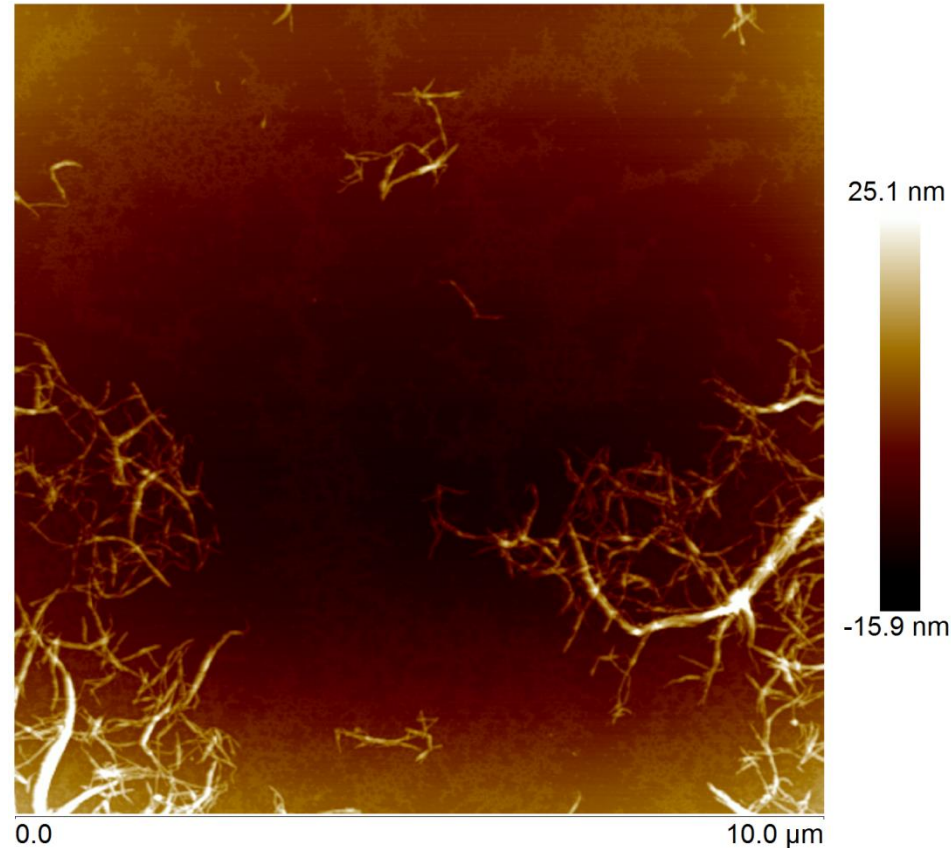




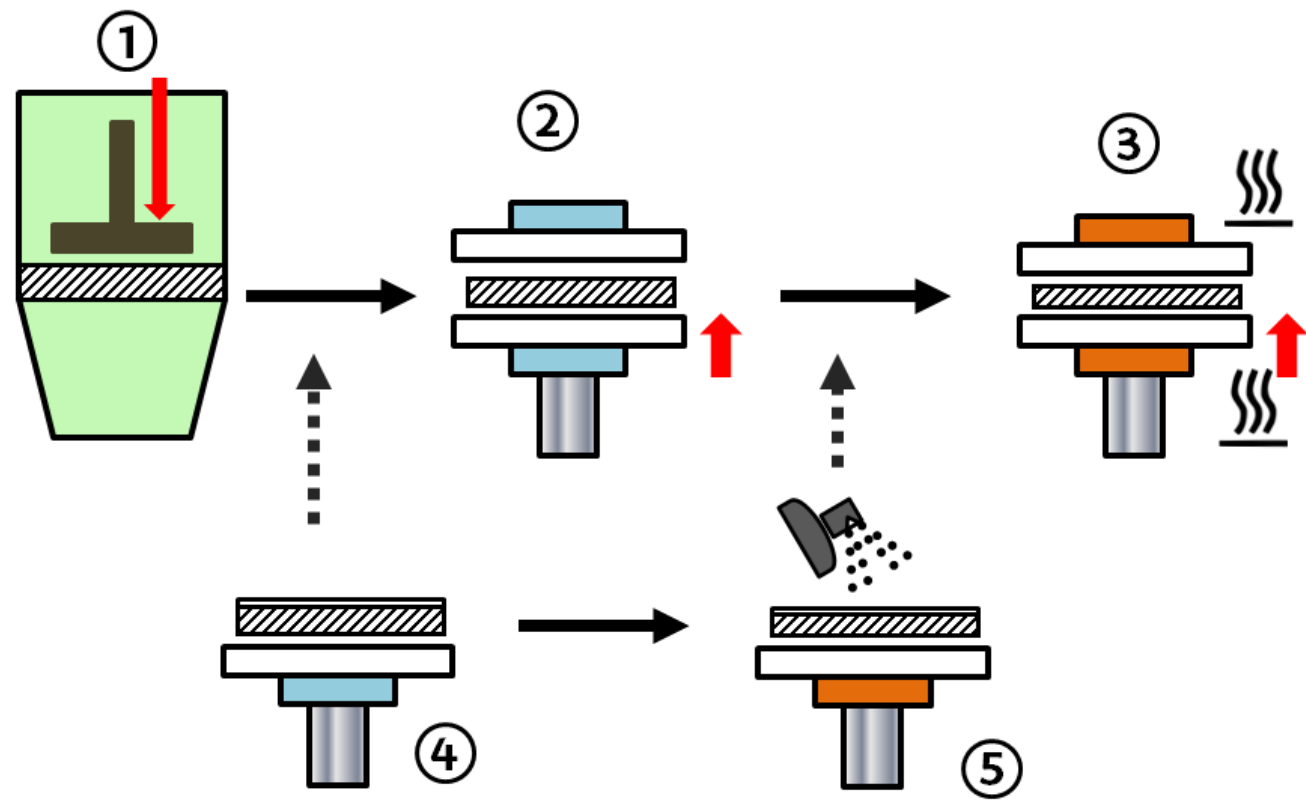
30 passes  
~1000 bar

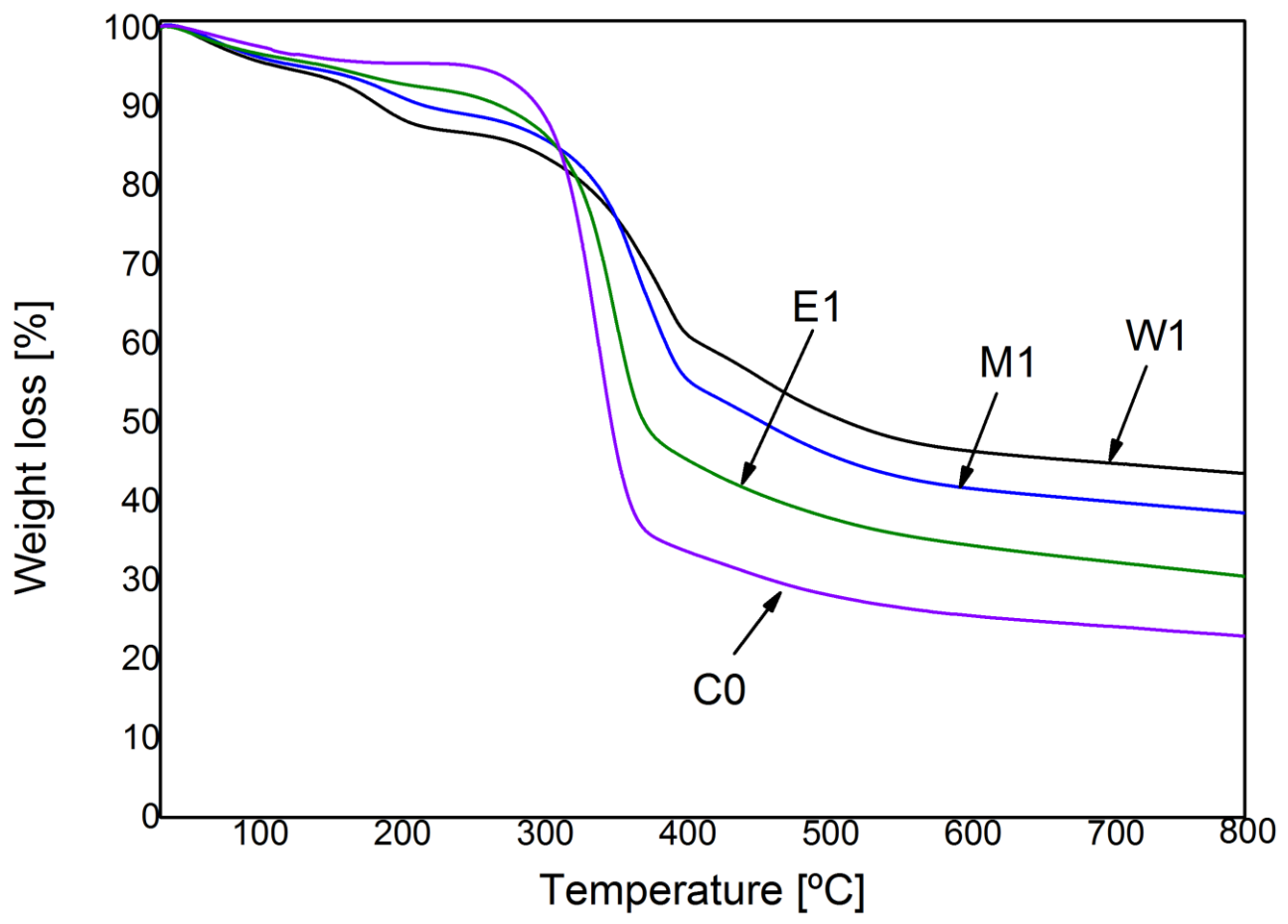


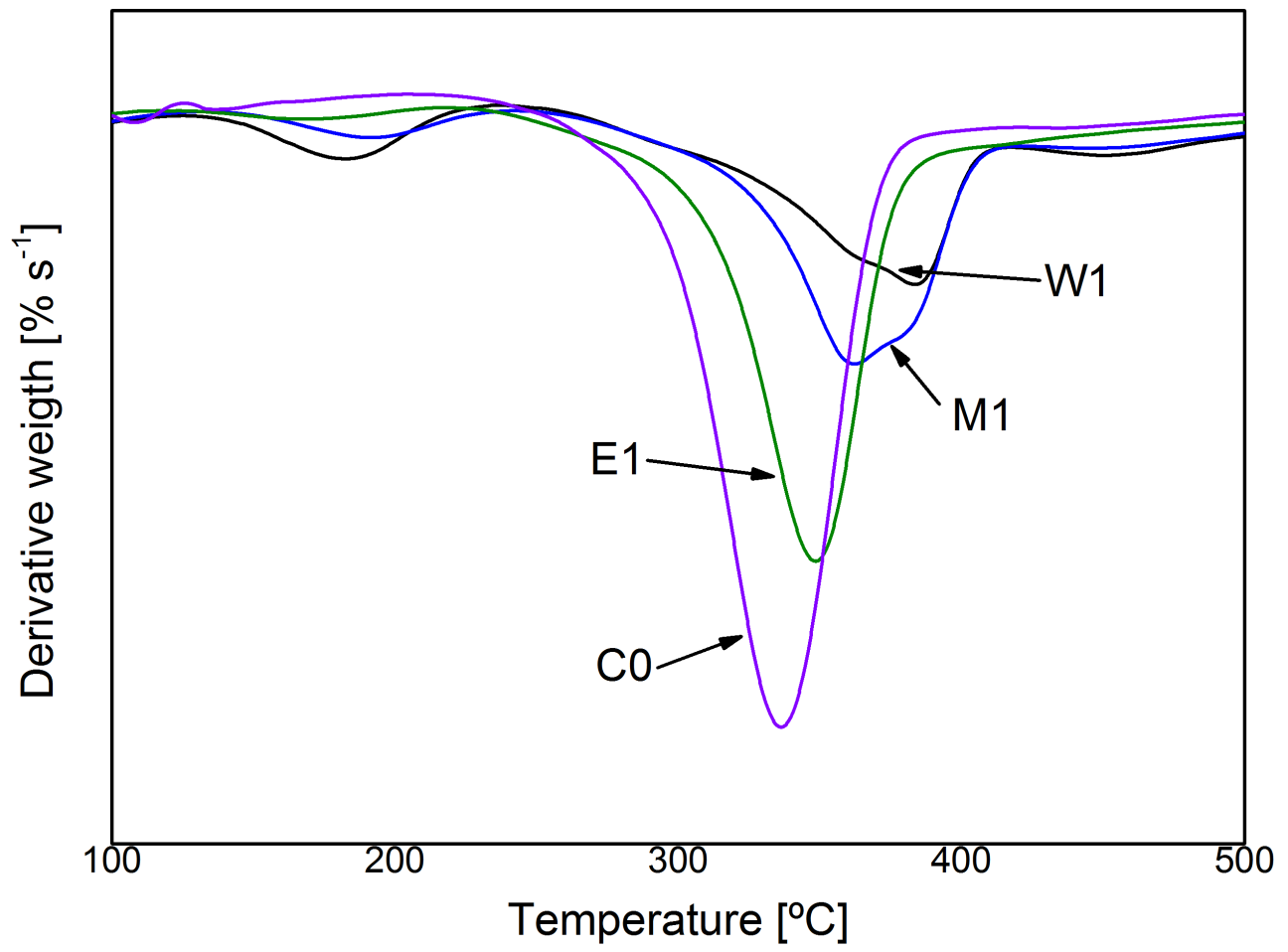
Cellulose nanofibers were modified with 3-Aminopropyl triethoxysilane (ATS) solution inside a plastic beaker to avoid ATS reactions with glass surface. Neat silane relation to cellulose nanofibers was 1:1, 2.5:1 and 5:1. ATS solution was first diluted in ethanol, ethanol-water (50/50) or water; pH was neutralized by dribbling acetic acid with constant stirring, once pH was stable, CNF were dispersed in ethanol, ethanol-water (50/50) or water at approximately 3 wt% and added to their corresponding silane solution. The mixture was stirred with a Silent crusher homogenizer at 1500 rpm during 5 min and left at room temperature for another 45 min. The slurry was vacuum-filtered to stabilize the cellulose content and kept at 3 wt% in the form of gel.



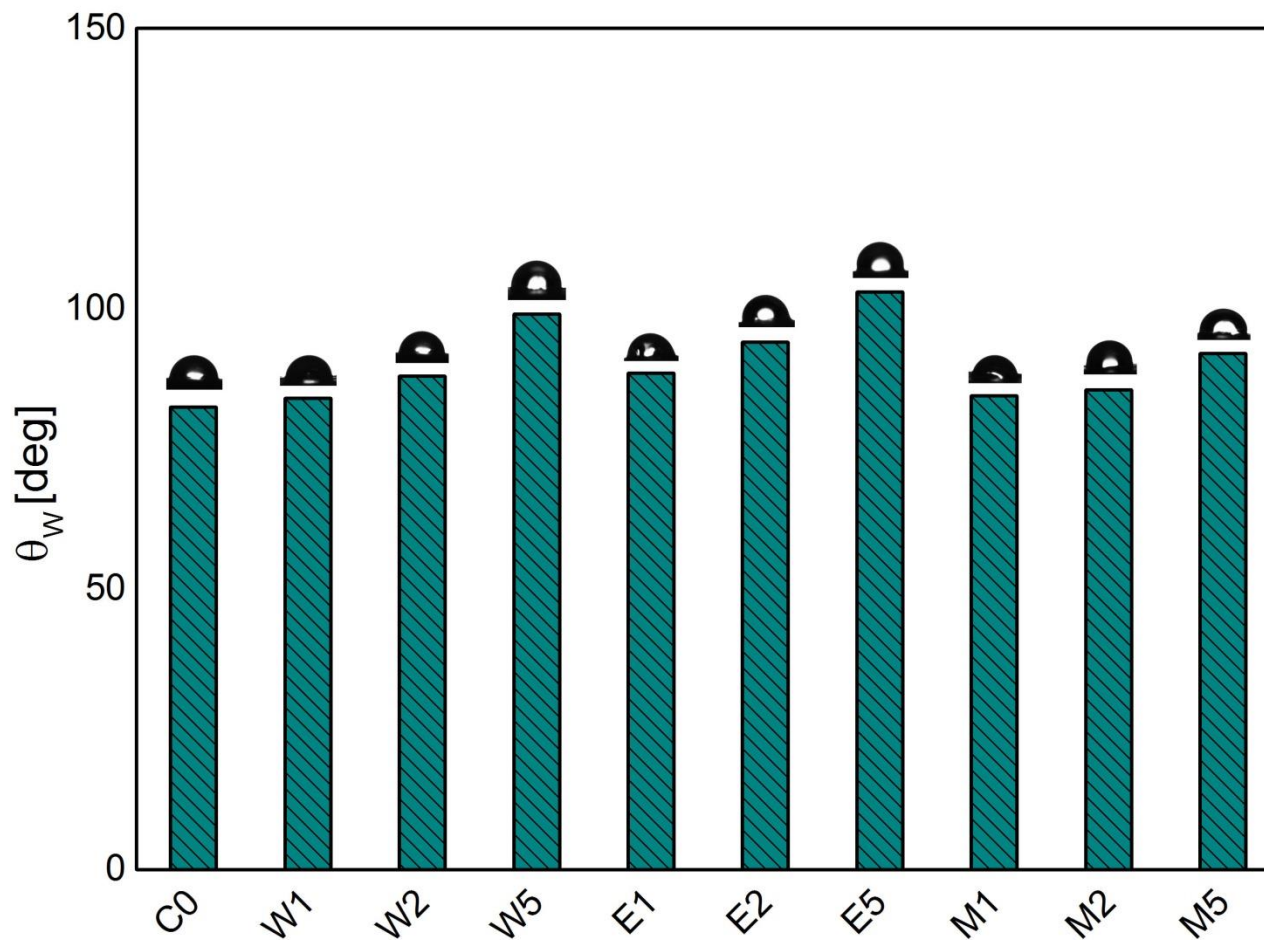


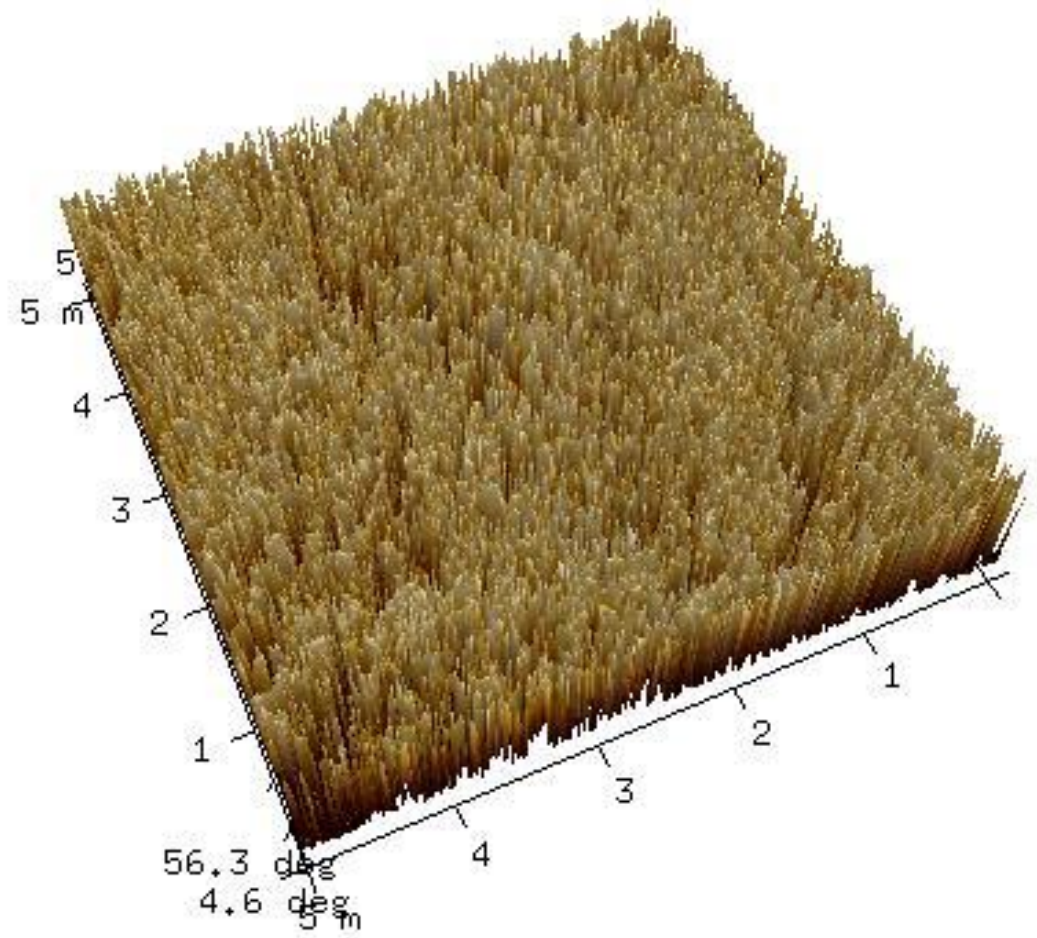






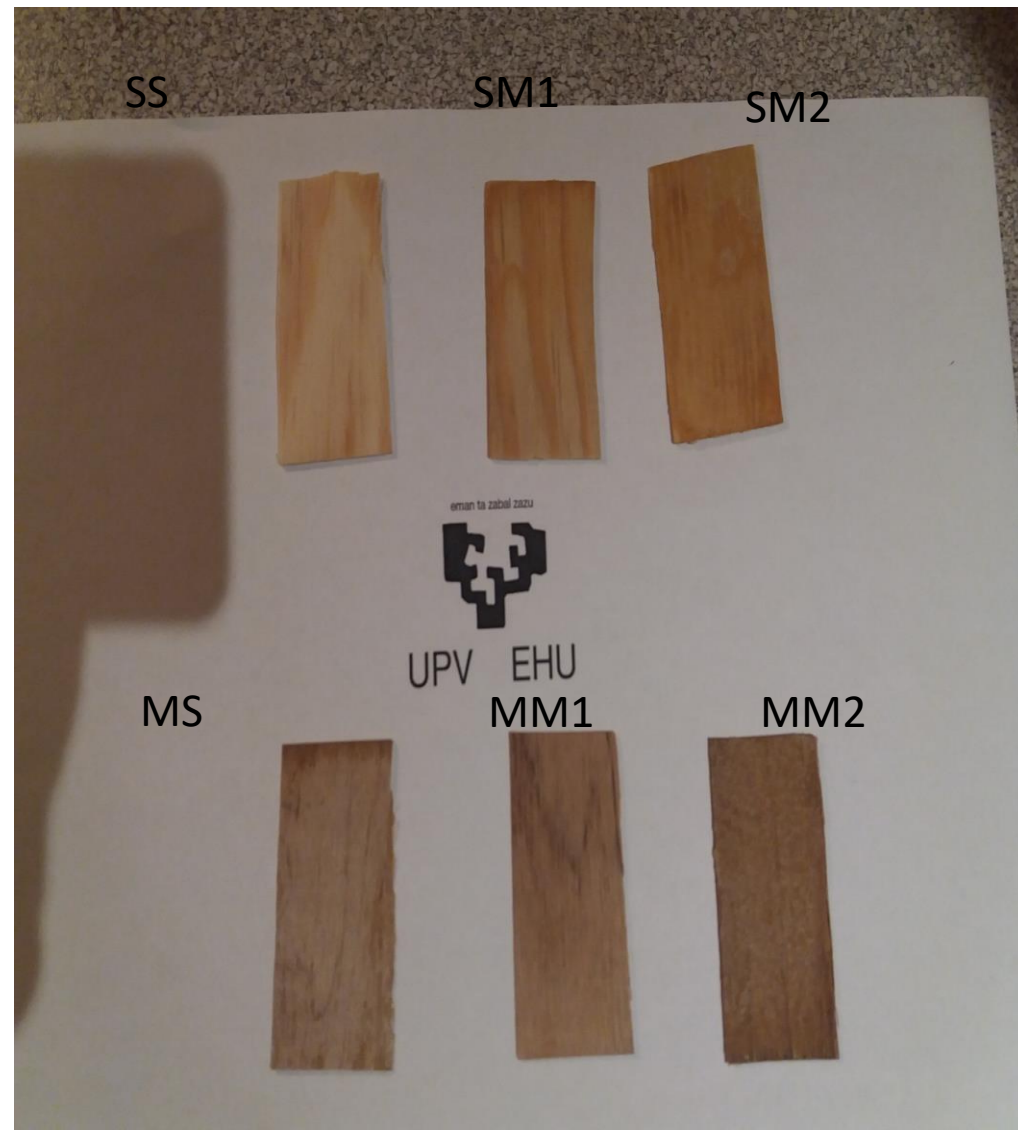
## Powder X-Ray Diffraction raw scatters





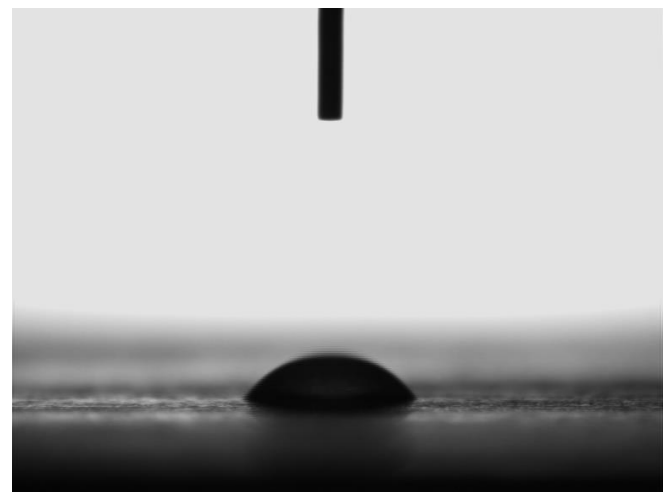
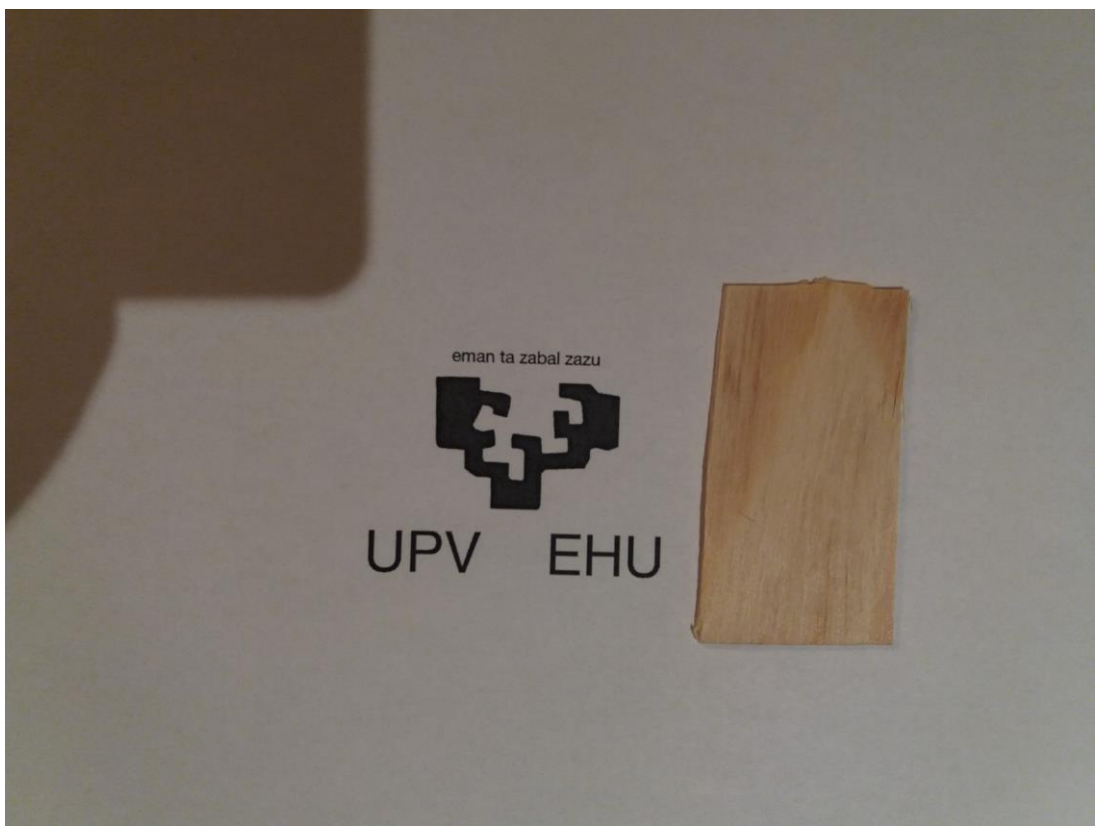
Sample	$\gamma_s$ [mN m <sup>-1</sup> ]	$\Upsilon\gamma_s^d$ [mN m <sup>-1</sup> ]	$\gamma_s^p$ [mN m <sup>-1</sup> ]	$\theta$ Water [deg]
SS	55.63	35.5	18.3	54.9
SM1	45.95	37.06	8.89	70.6
SM2	43.45	37.28	6.17	76.5
MS	41.40	41.08	0.32	108.4
MM1	43.79	43.75	0.03	117.7
MM2	41.78	40.53	1.25	111.3

Sample	$\gamma_s$ [mN m <sup>-1</sup> ]	$\Upsilon\gamma_s^d$ [mN m <sup>-1</sup> ]	$\gamma_s^p$ [mN m <sup>-1</sup> ]	$\theta$ Water [deg]
B	45.37	42.24	3.13	73.47 (1)
BC	49.73	34.85	14.88	57.23 (5)
BN	46.31	36.03	10.28	63.73 (2)
BS	41.41	37.84	3.57	79.43 (4)
BF	39.60	36.35	3.24	81.73 (3)

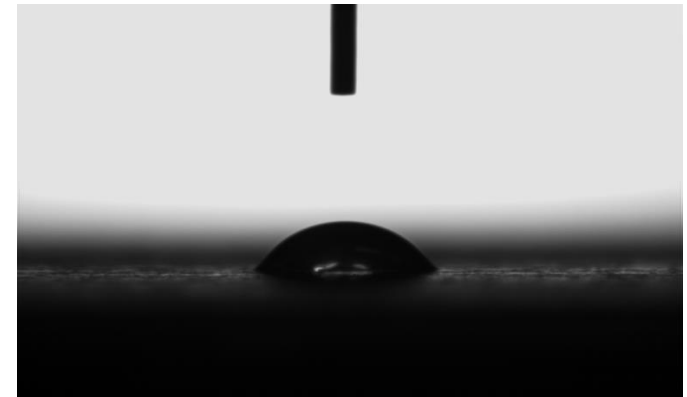
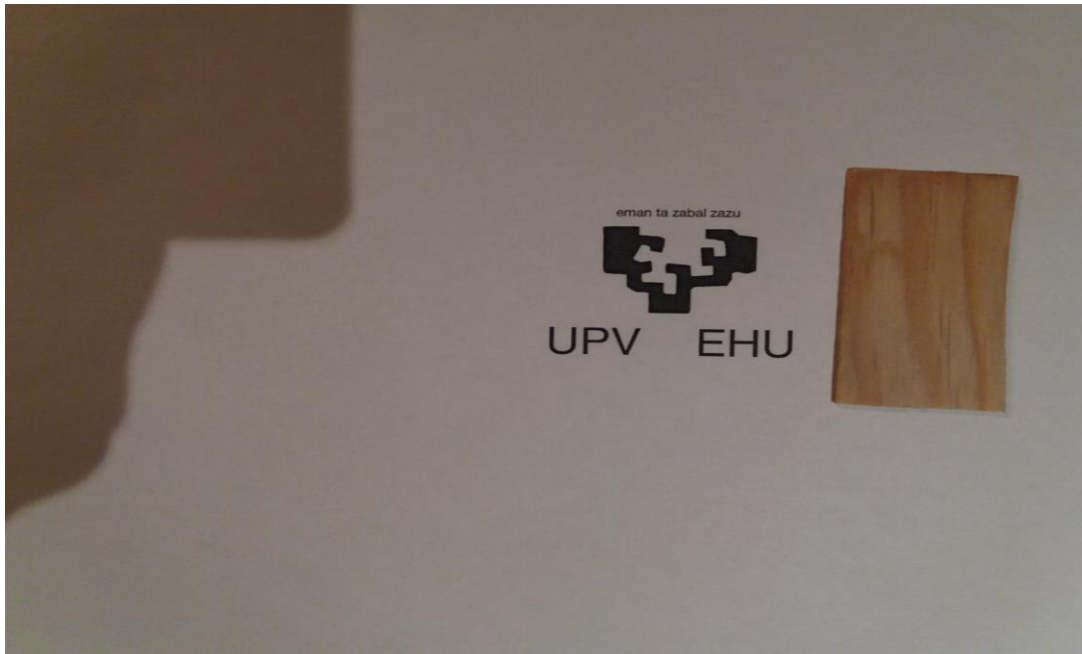




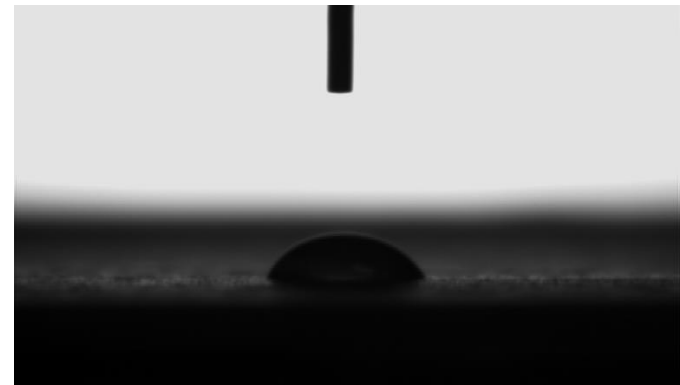
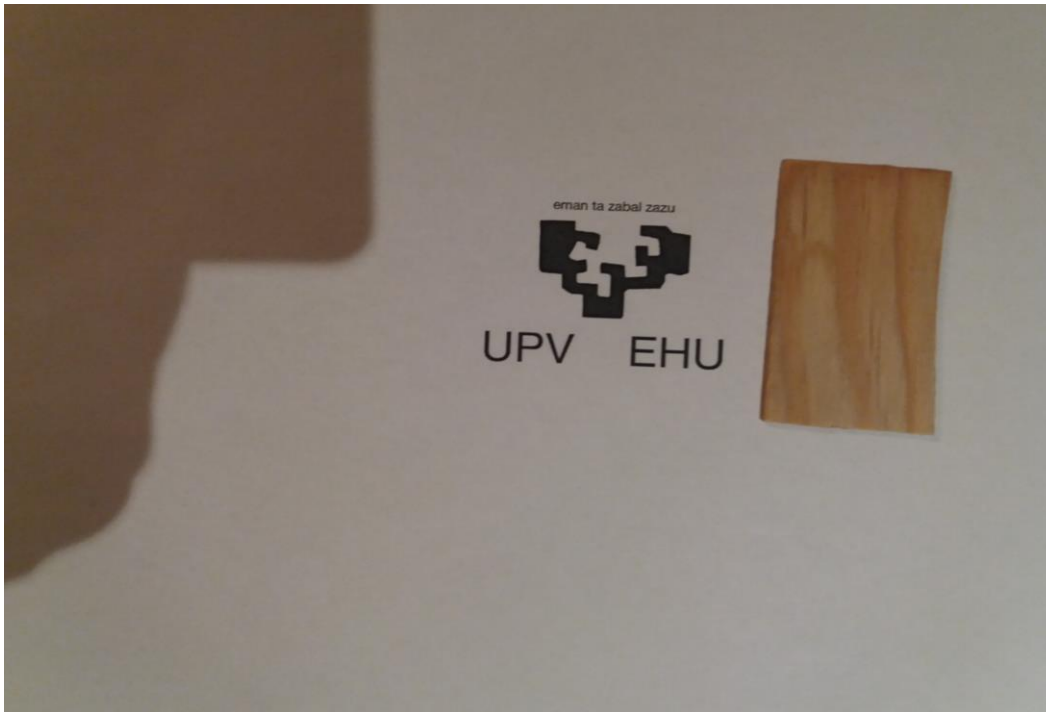
# SS



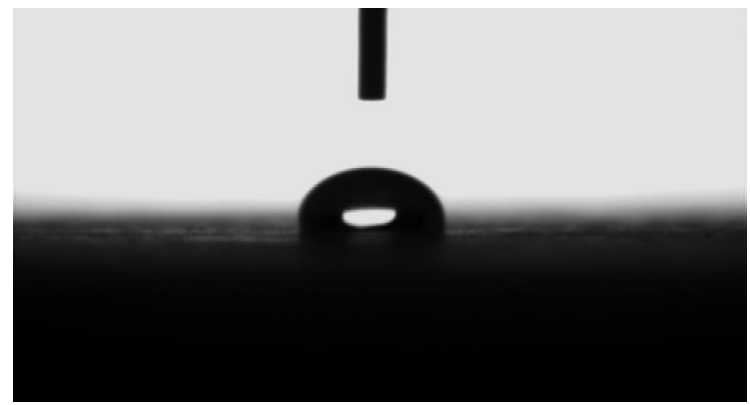
# SM1



# SM2



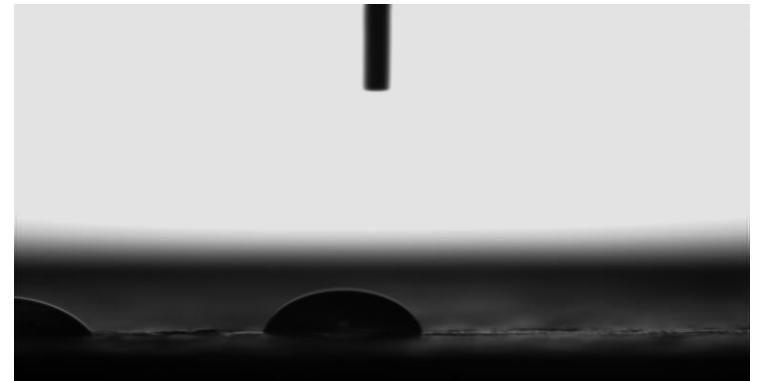
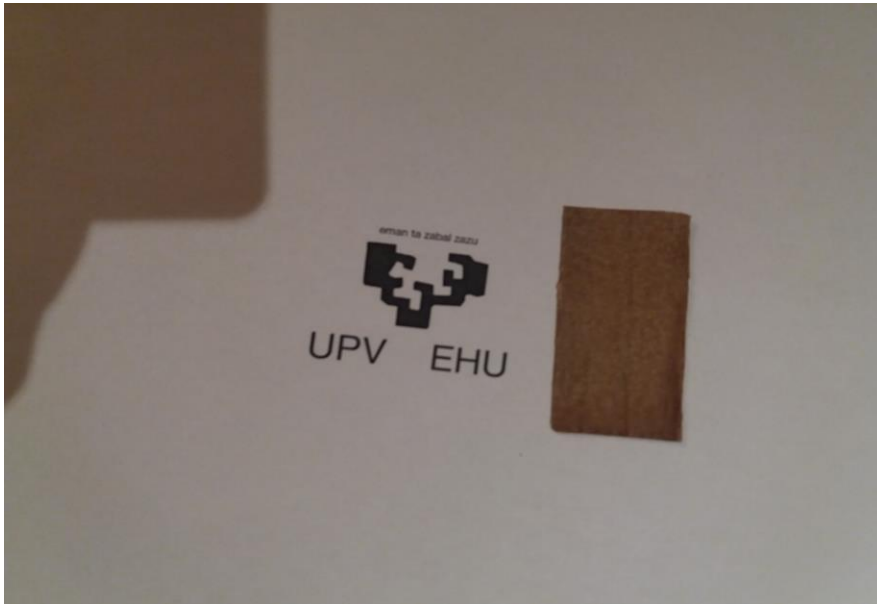
# MS



# MM1

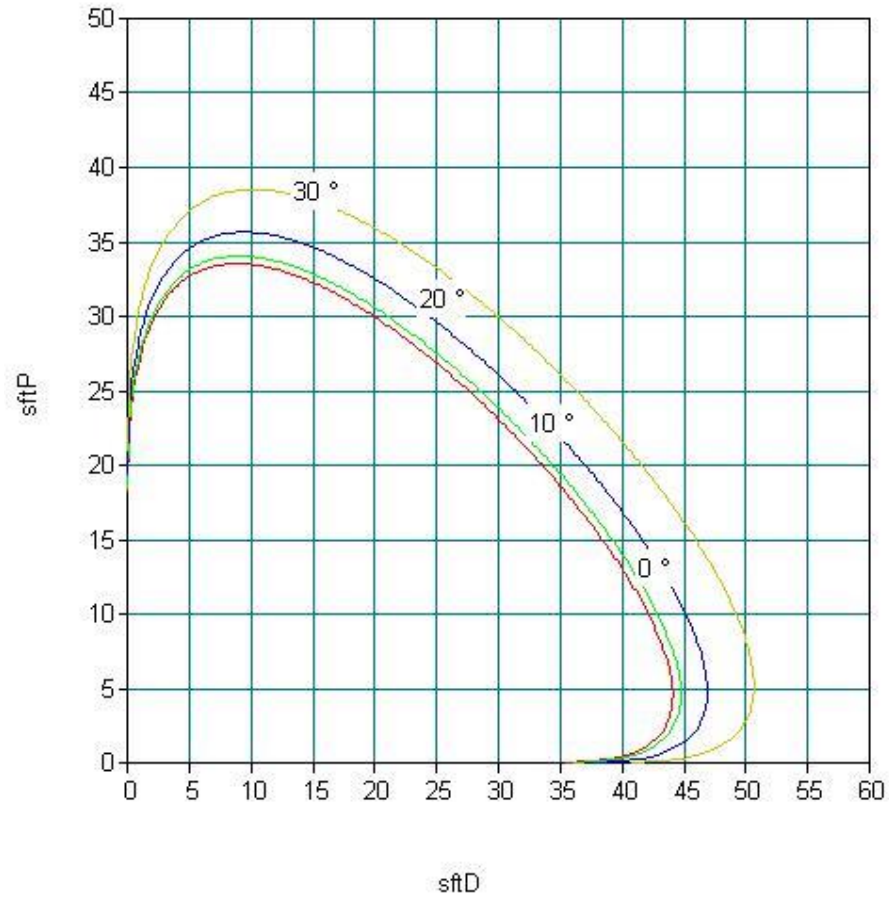


# MM2



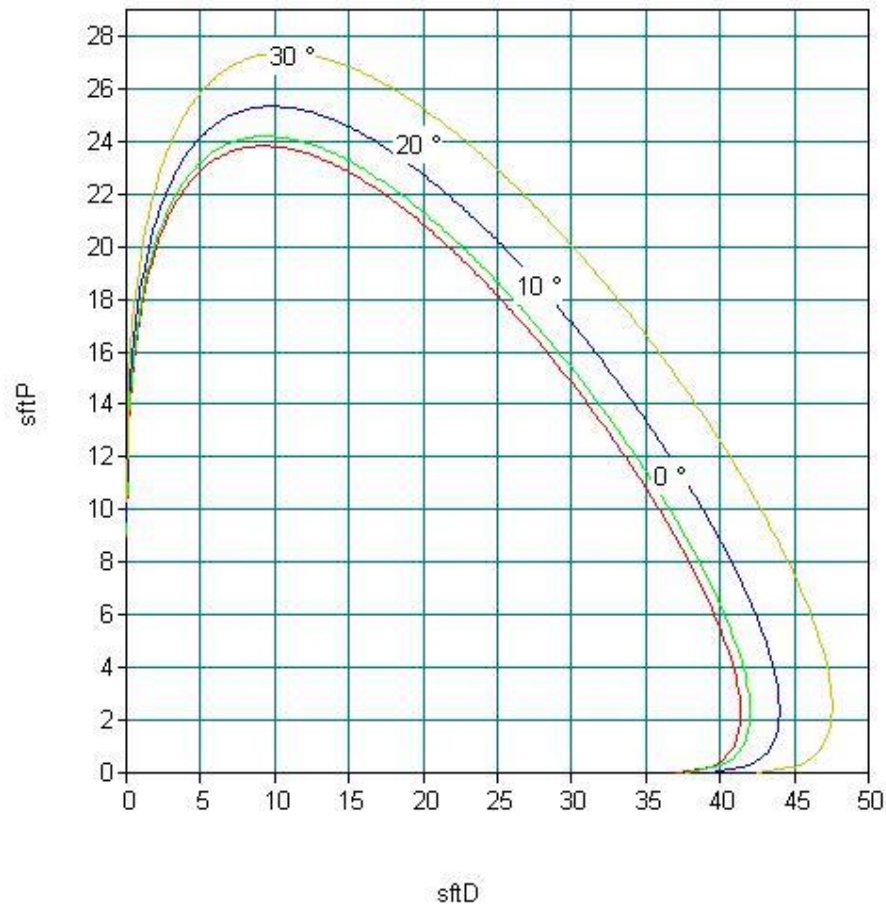
SS

### Wetting Envelope (OWRK)



# SM1

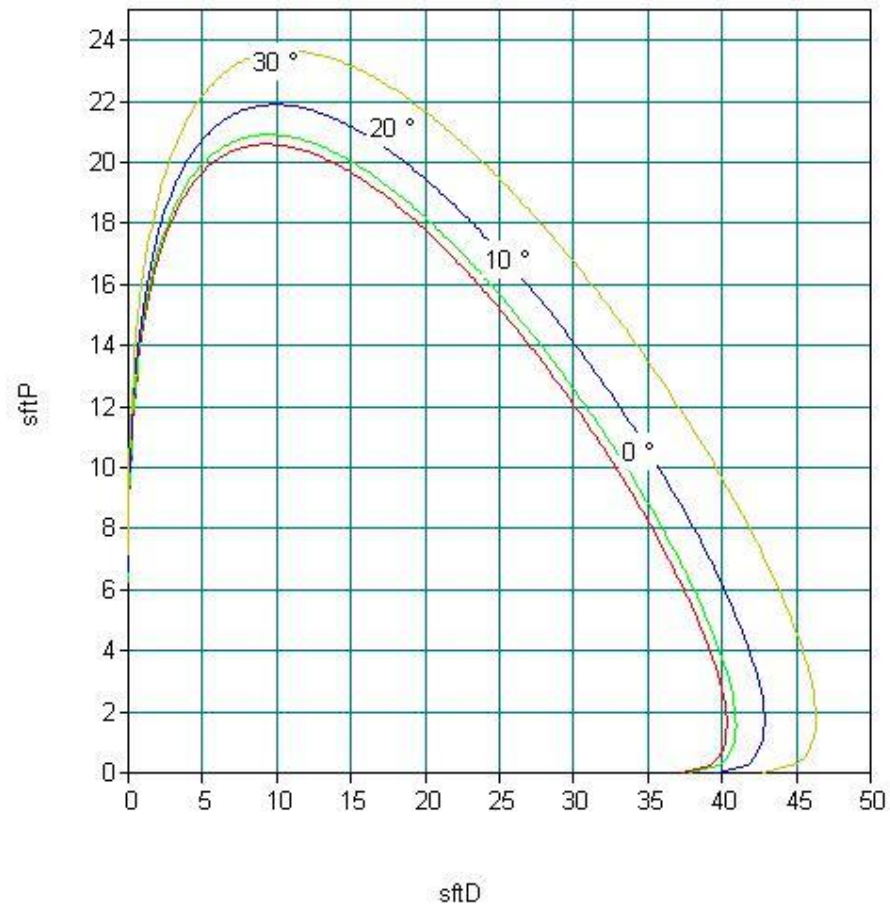
## Wetting Envelope (OWRK)





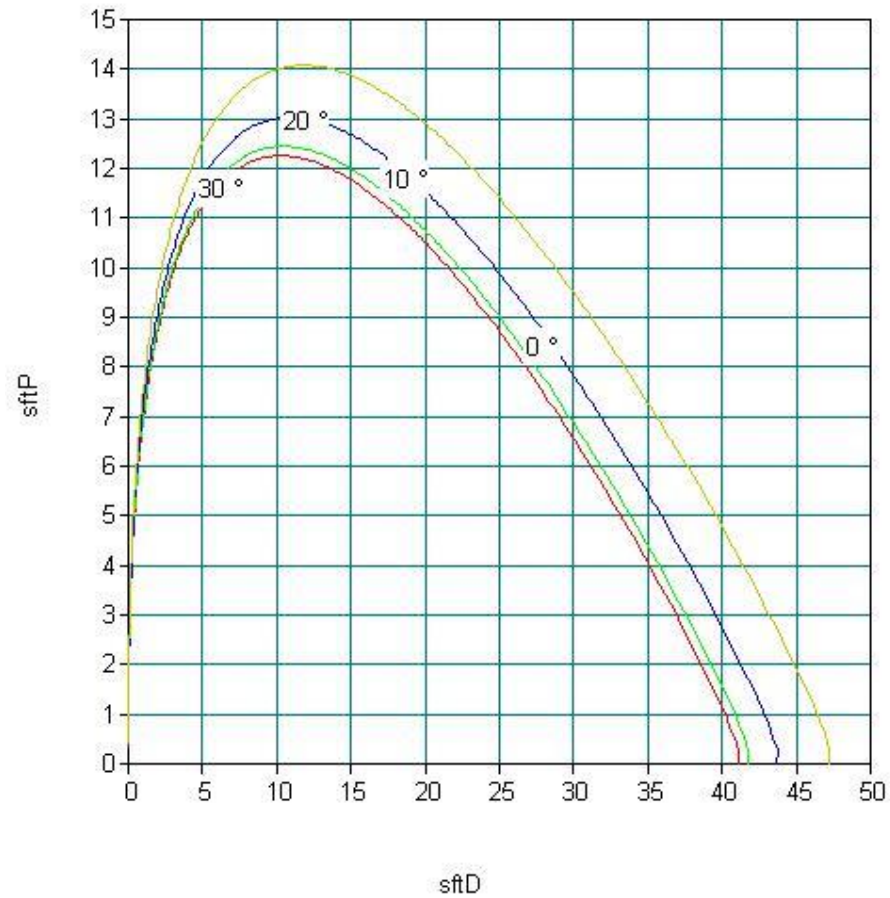
# SM2

## Wetting Envelope (OWRK)



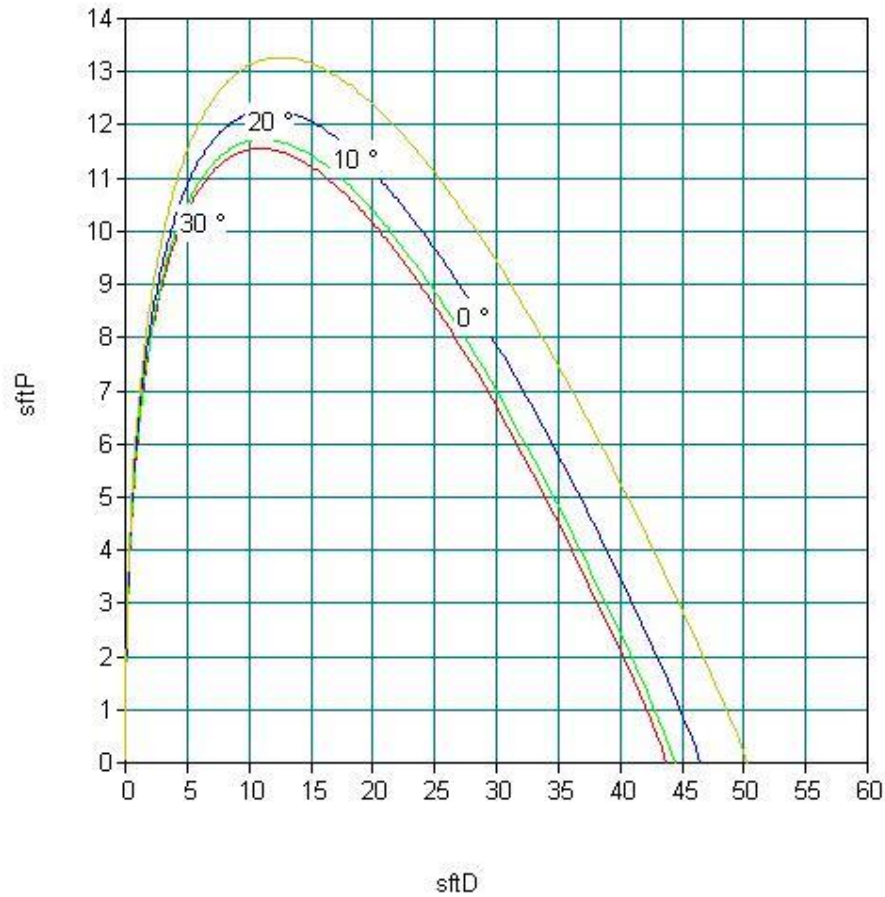
MS

### Wetting Envelope (OWRK)



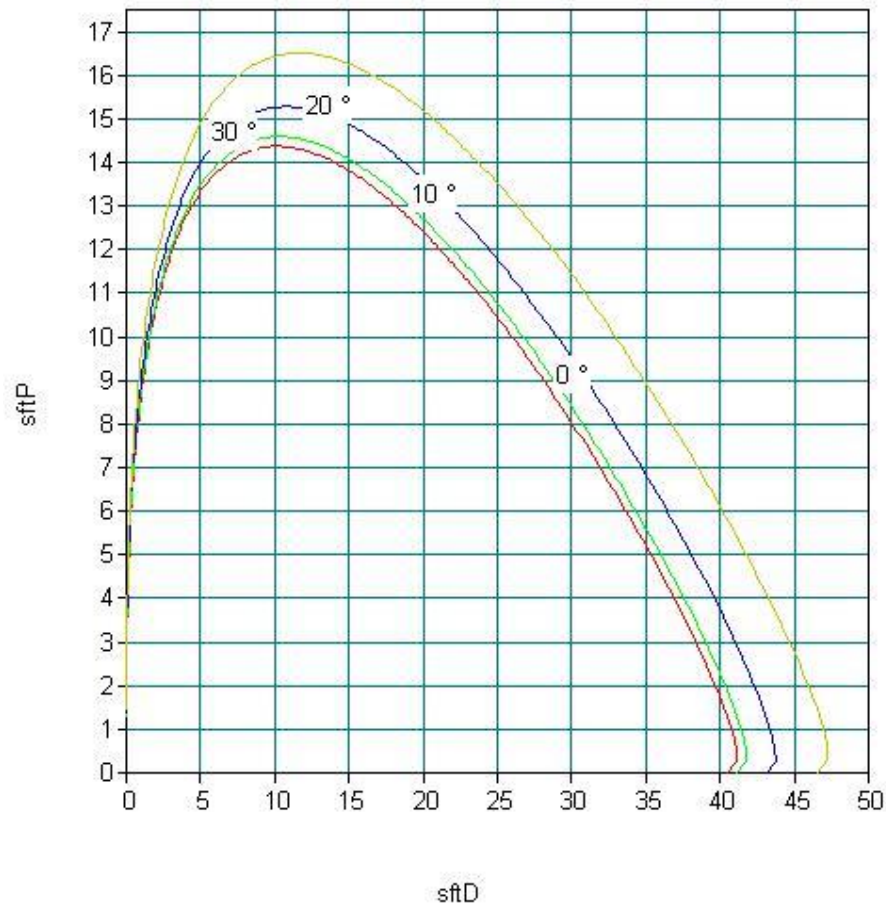
# MM1

## Wetting Envelope (OWRK)



# MM2

## Wetting Envelope (OWRK)



# Thank you!

# Eskerrik asko



Questions?  
Comments?  
Complains?  
Proposals?



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