

Lignocellulosic multilayer self-bonded composites with modified cellulose nanoparticles for enhanced water performance

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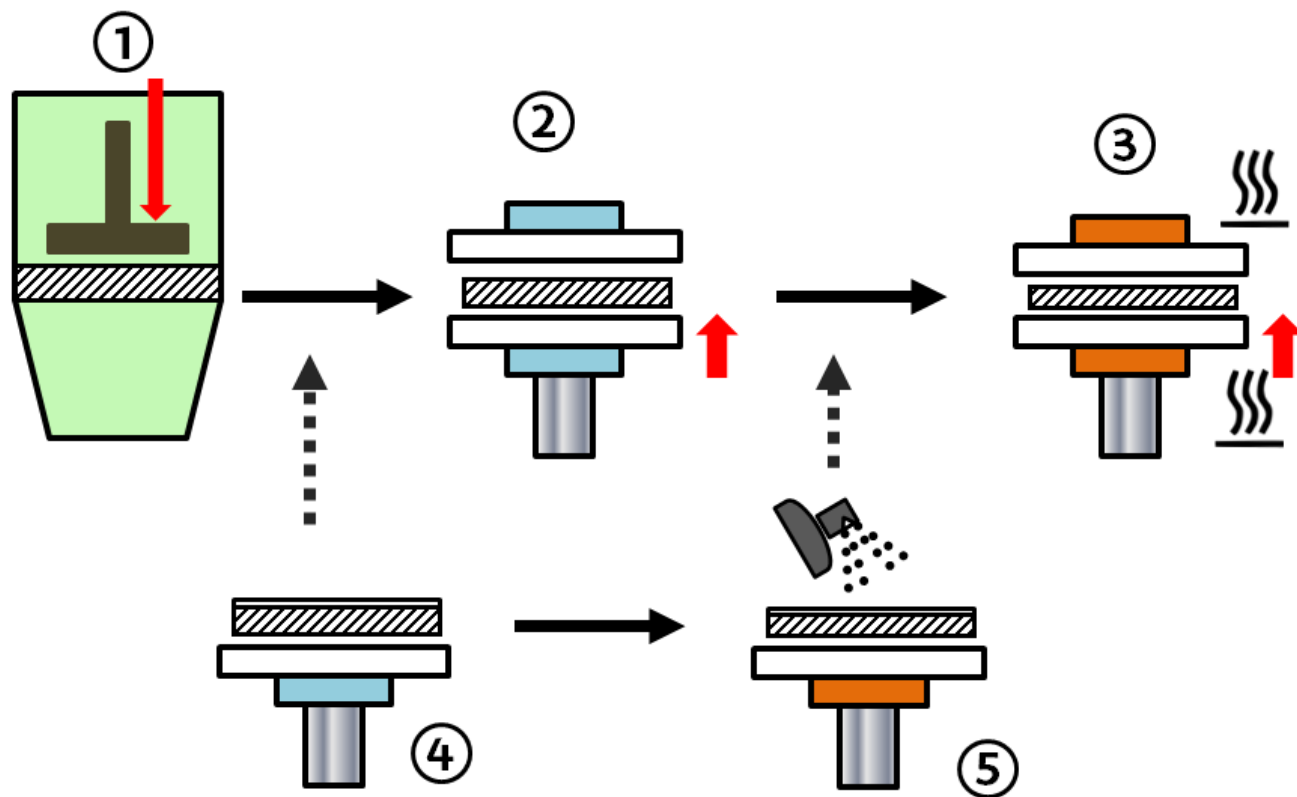
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- Cellulose nanofibers either neat or modified with 3-Aminopropyl Triethoxysilane or Dodecanoyl Chloride
- Surface water absorption (ASTM D5795 – 95)
- Water uptake (ASTM D1037 – 12)
- Vertical density profile



Schematic description of the composite elaboration



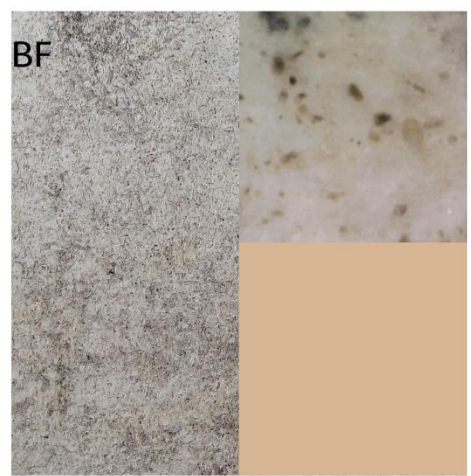
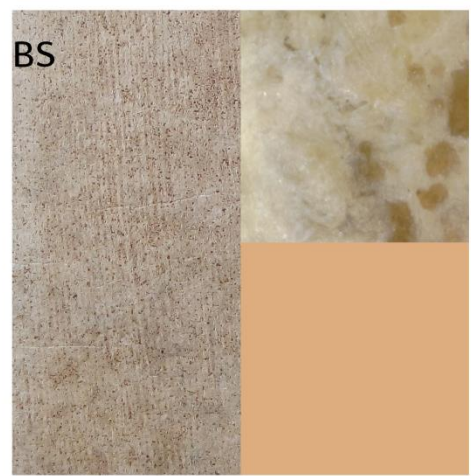
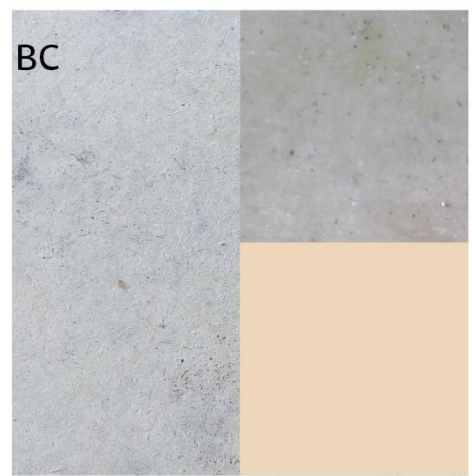
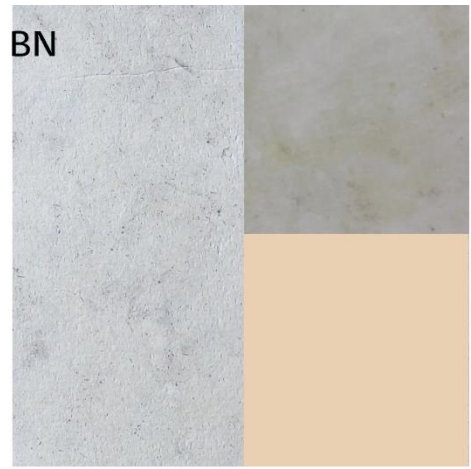
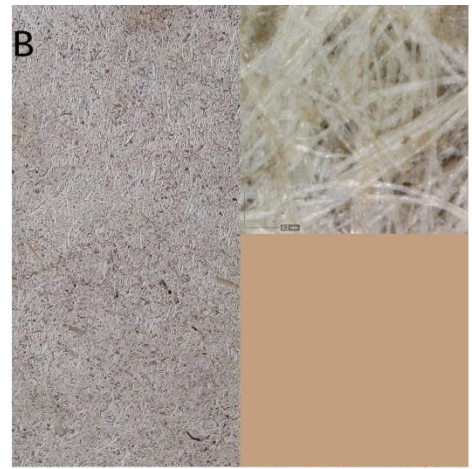


Description of the different composites.

Sample	Base layer			External layers		
	Composition [%]		Average Thickness [mm]	Second layer	Third layer	Average Thickness [mm]
	Industrial fibers	Blue agave bagasse				
B	80	20	~3.00	-	-	-
BC	80	20	2.80-2.90	Cellulose	-	~0.15
BN	80	20	2.80-2.90	Cellulose	CNF	~0.15
BS	80	20	2.80-2.90	Cellulose	CNF+APTES	~0.15
BN	80	20	2.80-2.90	Cellulose	CNF+DDC	~0.15

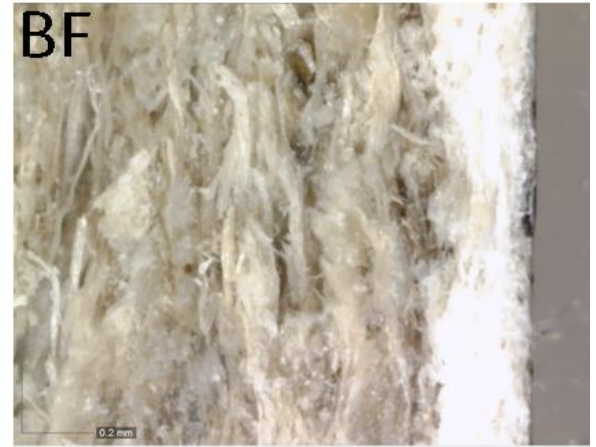
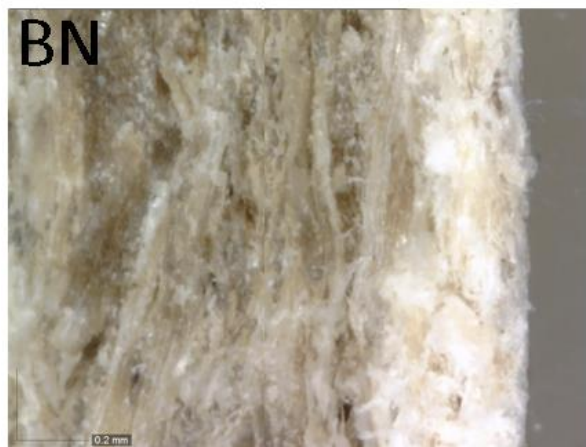
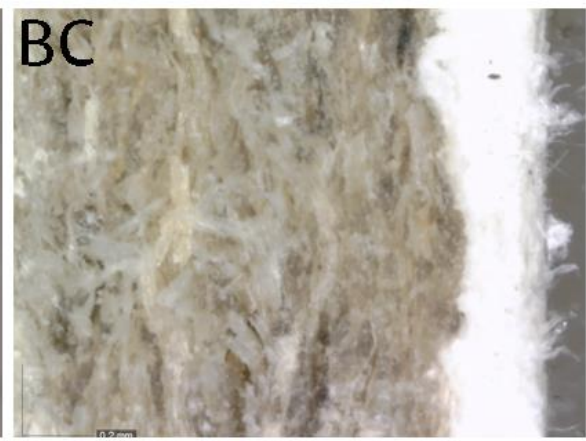
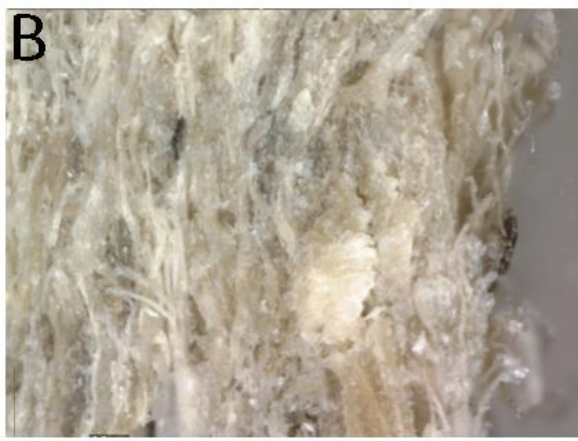


Optical appearance of each composite



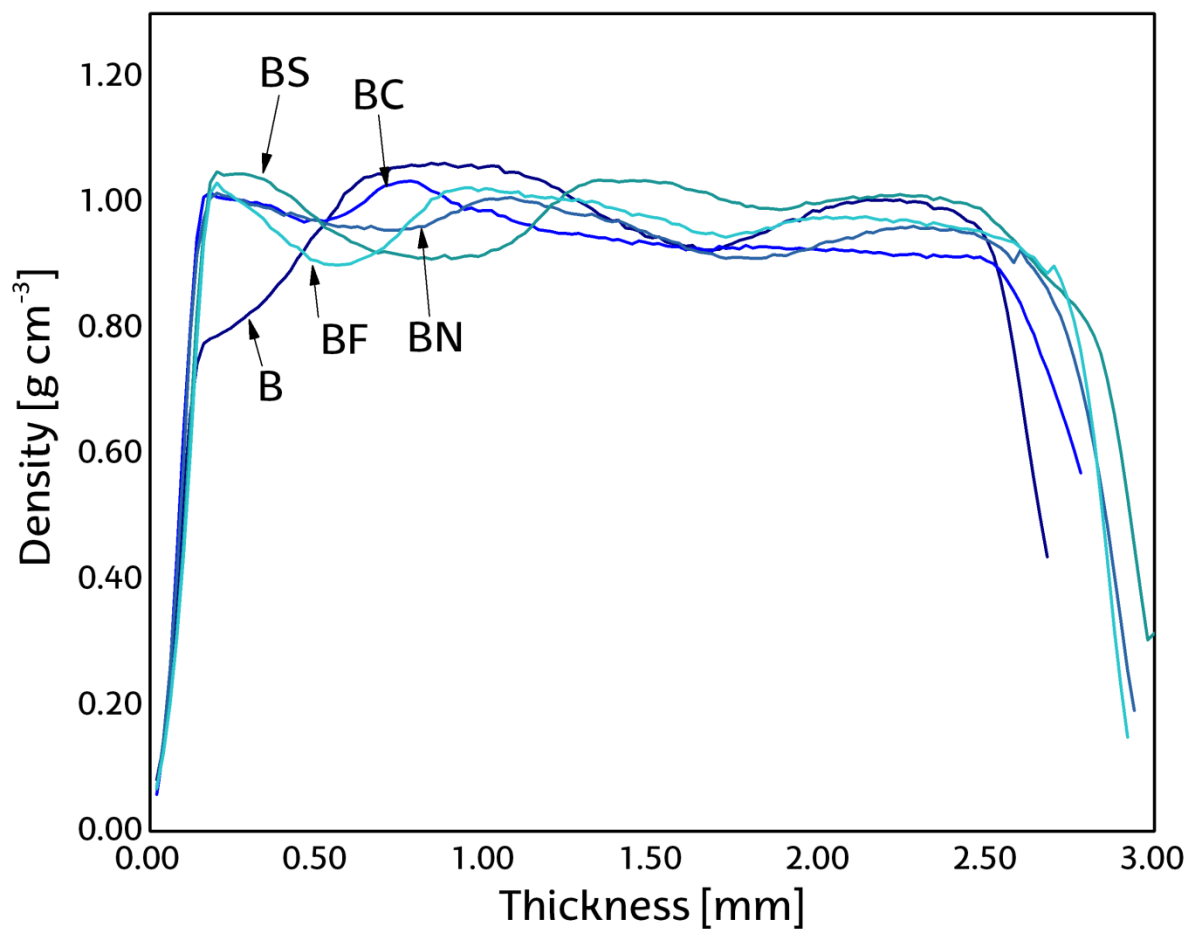


Optical appearance of lateral cut of each composite at 230x.





Initial density profiles of the elaborated composites



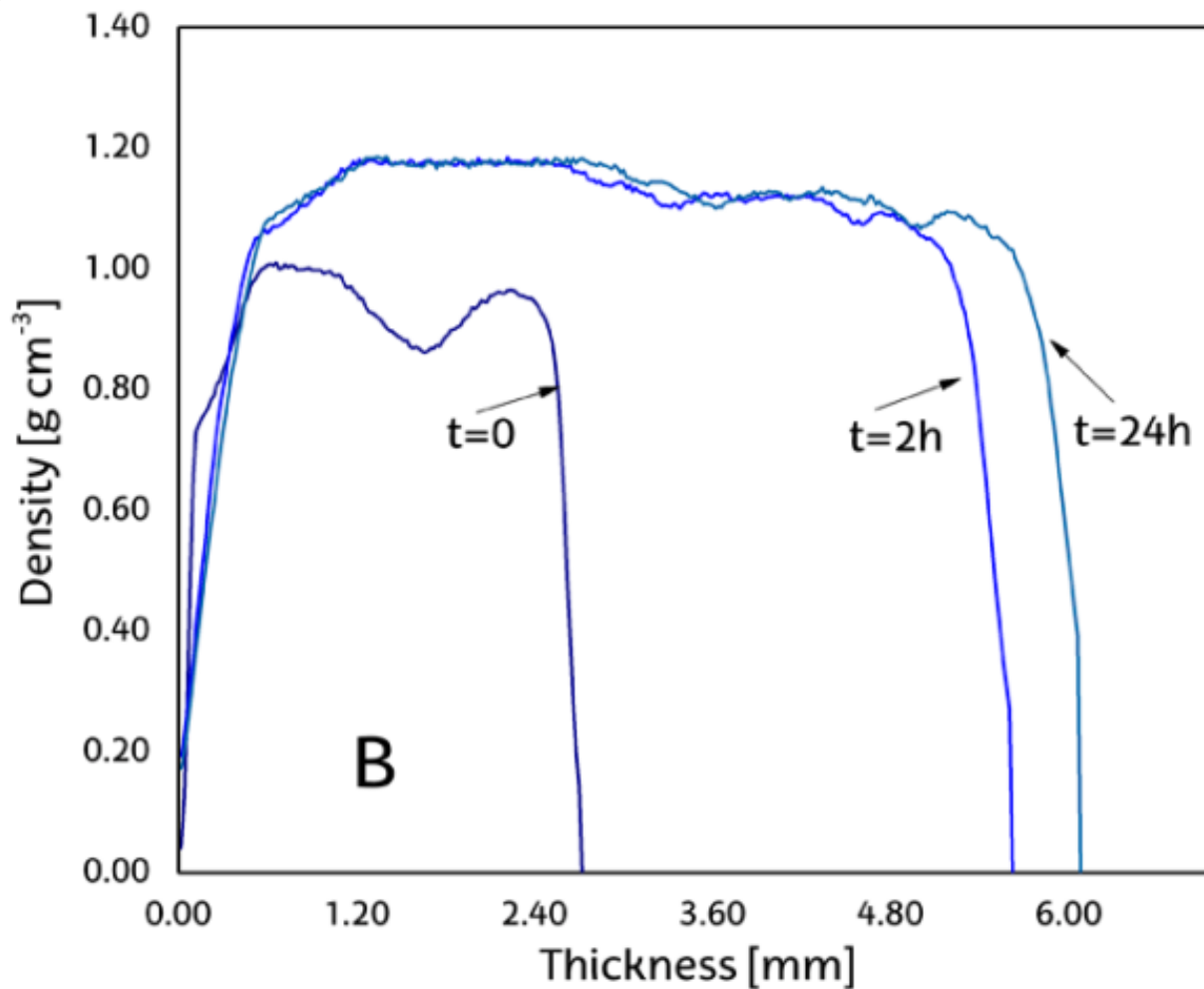


Surface interaction with liquids (numbers in parenthesis represent %RSD)

Sample	γ_s [mN m ⁻¹]	$\gamma\gamma_s^d$ [mN m ⁻¹]	γ_s^p [mN m ⁻¹]	θ Water [deg]	Surface Water Absorption [mg mm ⁻²]	Water uptake [mg mm ⁻³]		Thickness swelling [mm mm ⁻¹]	
						t = 2 h	t = 24 h	t = 2 h	t = 24 h
						B	45.37	42.24	3.13
BC	49.73	34.85	14.88	57.23 (5)	4.45 (6)	5.61 (6)	6.48 (6)	1.05 (6)	1.19 (6)
BN	46.31	36.03	10.28	63.73 (2)	3.10 (15)	4.13 (14)	4.63 (15)	0.76 (15)	0.83 (18)
BS	41.41	37.84	3.57	79.43 (4)	3.55 (6)	5.95 (2)	6.60 (1)	1.10 (11)	1.21 (7)
BF	39.60	36.35	3.24	81.73 (3)	2.65 (6)	4.64 (4)	5.21 (4)	0.84 (4)	0.95 (5)

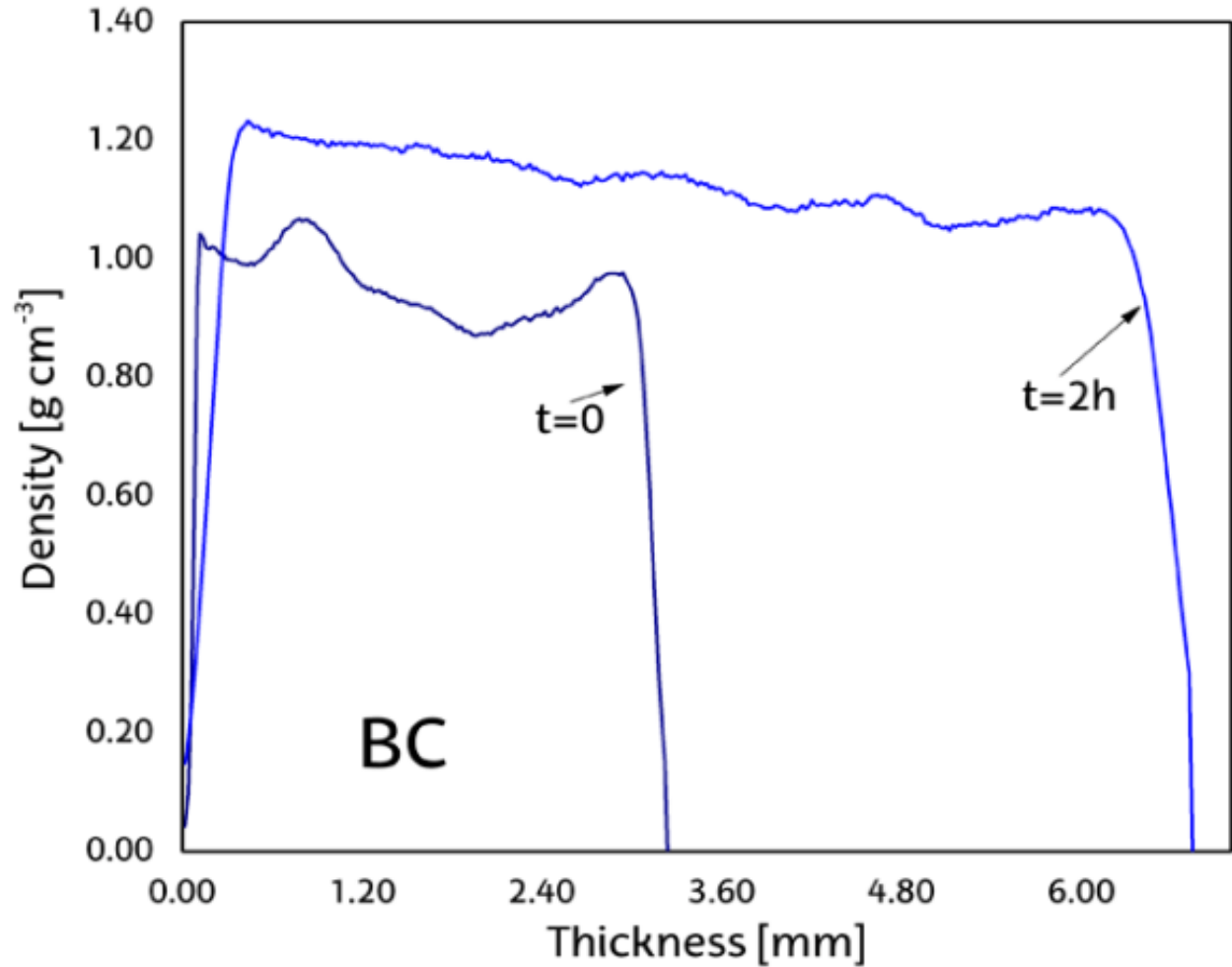


Density profile



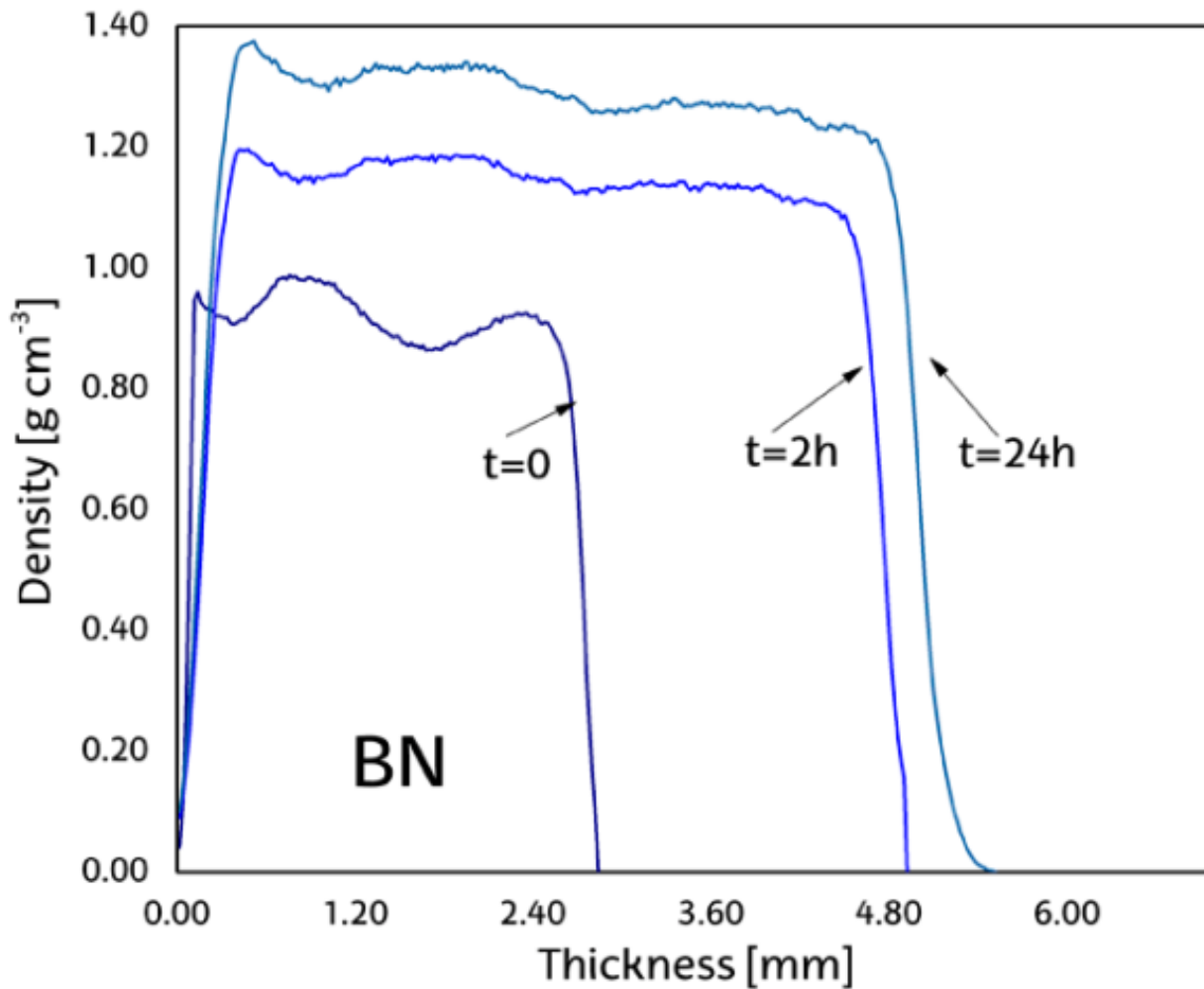


Density profile



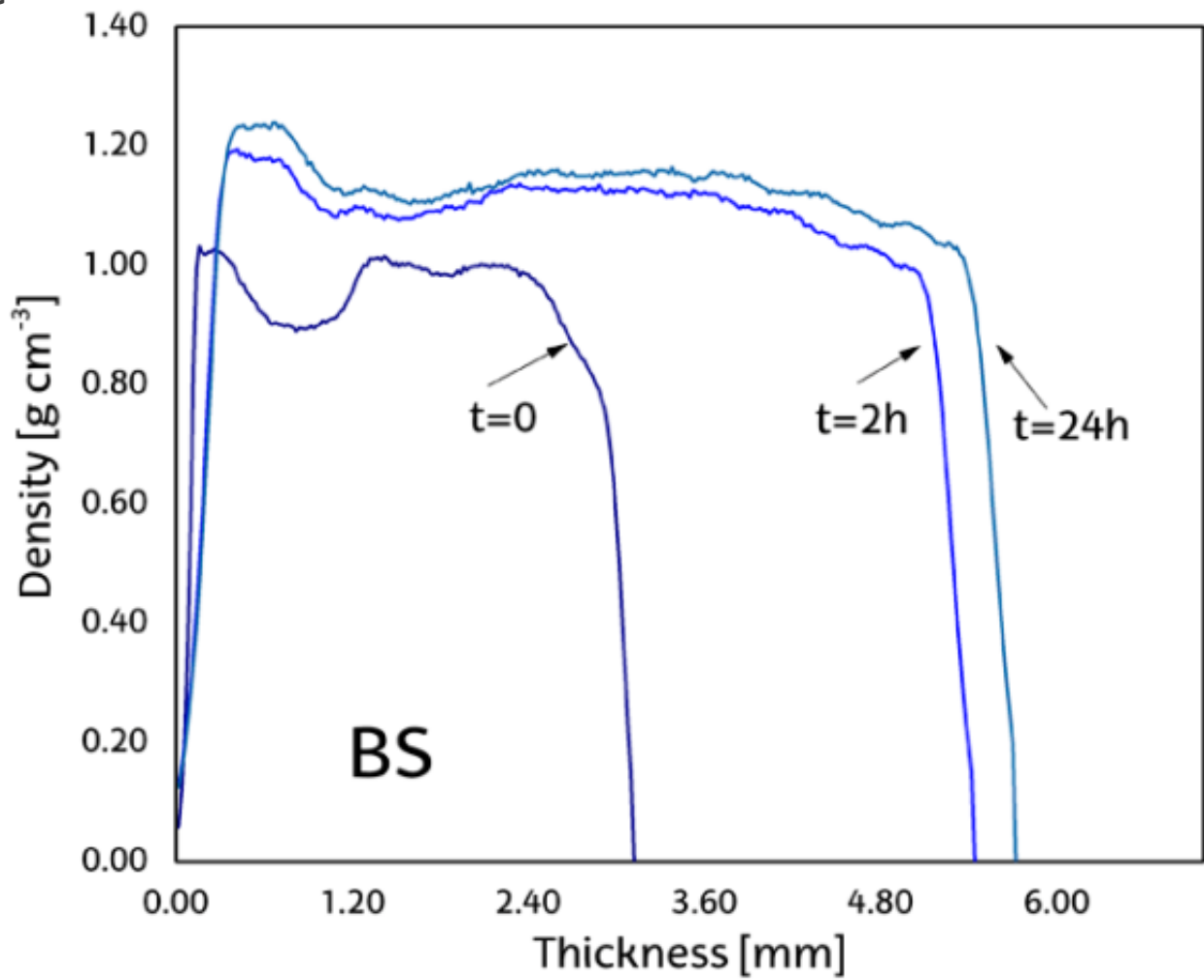


Density profile





Density profile





Conclusions

- Difference after 24 h is between 4-6 %
- Thickness swelling as well as density profiles after 2 and 24 h soaking presented consistently the contribution of cellulose nanofibers in external layers to reduce the water content inside the composites
- Water penetration is reduced ~23 (BS) and ~42 % (BF) with respect to B



Thank you!
Eskerrik asko
Dziękuję





Questions?
Comments?
Complains?
Proposals?

