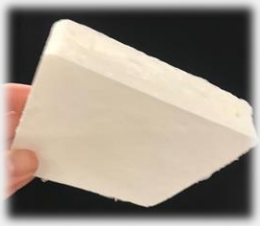
Breadcell foam Factsheet

Lightweight cellulose foams are produced from softwood pulp using “frothed” (F series) or “bioblown” (B series) method.



		F60	F80	F100	F130	B80	EPP*
Density, kg/m³		60	80	100	130	80	60
Compressive properties (ISO 844)*	Elastic modulus, MPa	0.074	0.3	0.194	0.781	0.472	
	Crushing strength at 25%, MPa	0.026	0.057	0.085	0.155	0.078	0.39
	Mean crushing strength, MPa	0.168	0.282	0.329	0.476	0.279	0.4
	Densification strain	0.91	0.87	0.86	0.81	0.92	0.65
	SEA*, J/g	1	1.7	2	3	1.5	3.8
Tensile properties (ISO 1926)	Mean max stress, MPa	0.102	0.259	0.323	0.399		0.62
	Mean Failure strain	0.14	0.14	0.14	0.15		0.14
Flexural properties (ISO 1209-2)*	Mean flexural strength, MPa	0.131	0.239		0.61		0.72
	SEA until 40 mm, mJ/g	9	20		22		
Shear properties (ISO 1922)	Shear modulus, kPa	653	950	1195	1999		
	Shear strength, kPa	14	19	30	40		
Impact properties	SEA, J/kg	51	52		64		
Drop test	Max. Acceleration, g	229		99	121	111	93
	HIC	532		208	289	231	238

* Breadcell foams may have one thin layer skin from moulding process, compression tests were performed in the out-of-plane direction.
* SEA, specific energy absorption
* Flexural tests were performed with skin on the top, facing the struck side.
* EPP, expanded polypropylene foam, reported by Xing, Y.; Sun, D.; Zhang, M.; Shu, G., Crushing Responses of Expanded Polypropylene Foam. Polymers 2023, 15 (9), 2059.

Mechanical behaviour of F series foams at high strain rate

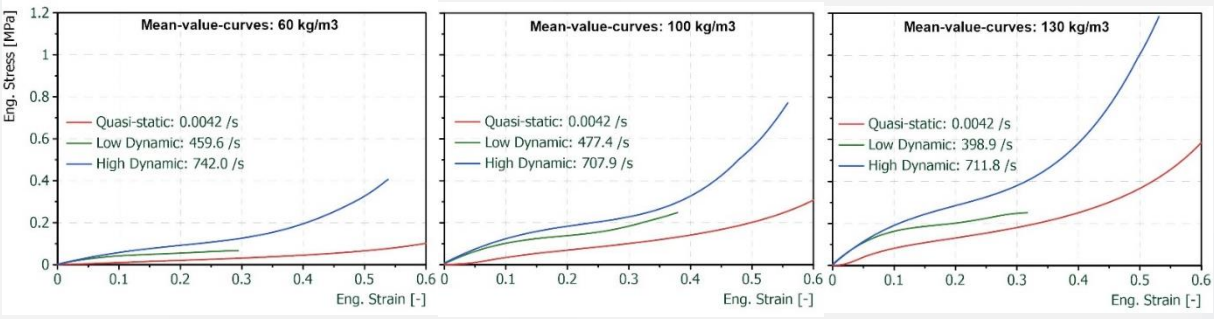


Figure: quasi-static, low and high dynamic loading conditions

Breadcell foams had water uptake of 18% at a relative humidity of 95%, aligning with other cellulose materials.

Within a temperature range of -40°C to 70 °C, F80 foams had a change of stiffness of only 16%.

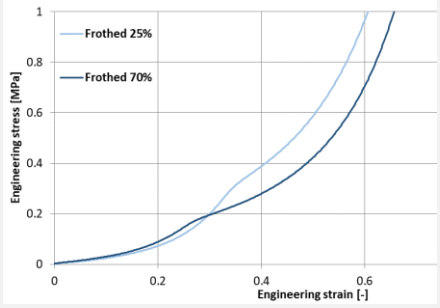


Figure: Similar mechanical behaviour at relative humidity of 25% and 75%

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 964430

Breadcell sandwich composite Factsheet

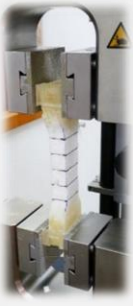
Breadcell sandwich composites (S series) are all cellulose based lightweight materials.

		S6	S2	S6n	S2n*	EPP*
Density, kg/m³		130	100	130	110	60
Foam core thickness, mm		20	20	12.5	16.6	
Skin thickness, mm		6	2	3.75	1.7	
Out-of-plane compressive properties (ISO 844)	Elastic modulus, MPa	0.993	0.271	0.253	0.138	
	Crushing strength at 25%, MPa	0.2	0.081	0.12	0.056	0.39
	Mean crushing strength, MPa	0.646	0.443	0.585	0.369	0.4
	Densification strain	0.68	0.8	0.8	0.85	0.65
	SEA*, J/g	4.9	2.9	3.3	2	3.8
In-plane compressive properties (ISO 844)	Elastic modulus, MPa			7.3	3.9	
	Crushing strength at 25%, MPa			0.25	0.11	0.39
	Mean crushing strength, MPa			1.03	0.64	0.4
	Densification strain			0.93	0.92	0.65
	SEA, J/g			2.1	1.4	3.8
Tensile properties (ISO 1926)	Mean max stress, MPa			0.928	0.499	0.62
	Mean Failure strain			0.093	0.094	0.14
Flexural properties (ISO 1209-2)	Mean flexural strength, MPa			0.85	0.64	0.72
	SEA until 40 mm, mJ/g			43	29	
Shear properties (ISO 1922)	Shear modulus, kPa			849	946	
	Shear strength, kPa			26	23	
Out-of-plane impact properties	SEA, J/kg			87	82	
In-plane impact properties	SEA, J/kg			86	83	
Drop test	Max. Acceleration, g			183	154	93
	HIC			533	382	238

* S2n and S6n refer to sandwich composites normalised from S2 and S6. That means S2n and S6n have identical sandwich thickness; their skin/core ratios were identical to S2 and S6, respectively.

* EPP, expanded polypropylene foam, reported by Xing, Y.; Sun, D.; Zhang, M.; Shu, G., Crushing Responses of Expanded Polypropylene Foam. Polymers 2023, 15 (9), 2059.

* SEA, specific energy absorption



BreadCell

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