

Supporting Information to

3D-printed carbons with improved properties and oxidation resistance

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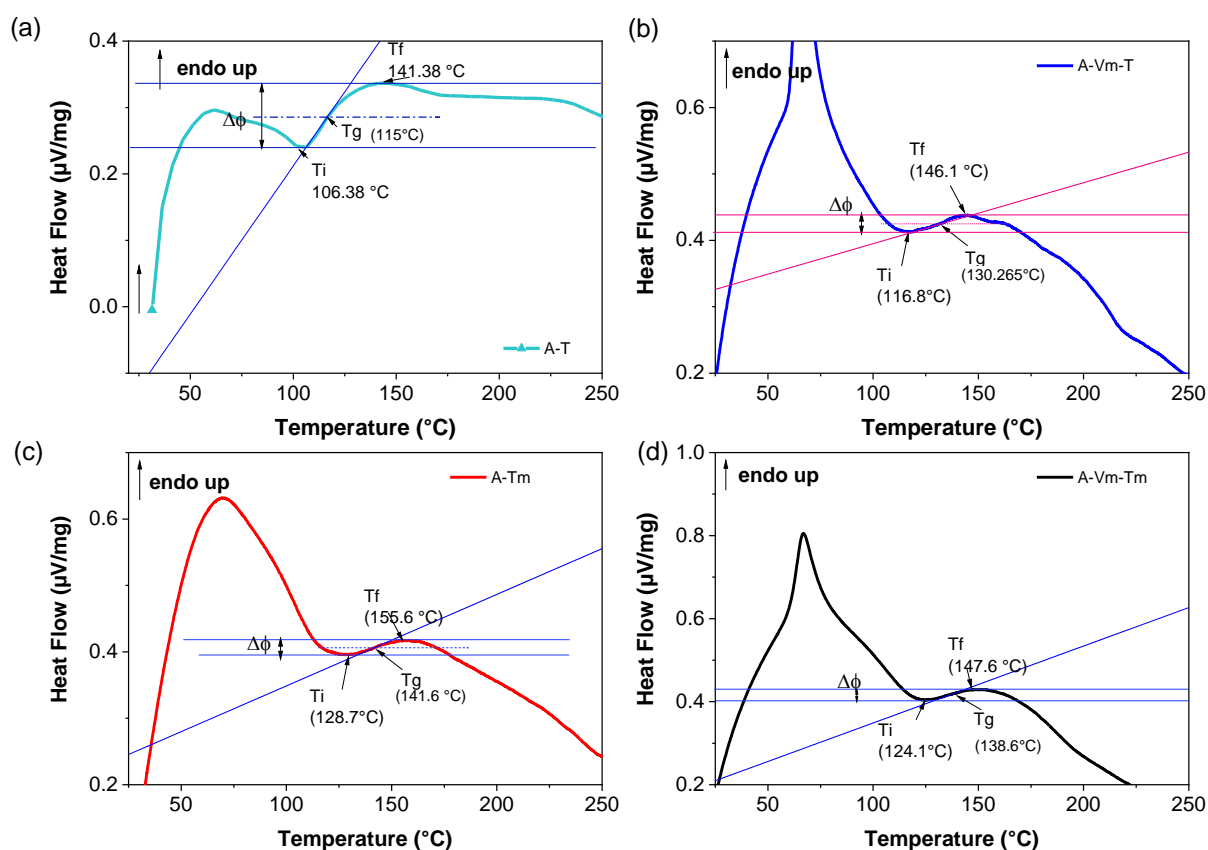


Figure S1. DSC profiles of: (a) A-Tm, (b) A-Vm-T, and (c) A-Vm-Tm resins, showing the glass transition temperature T_g .

Table S1. Chemical composition of 3D-printed carbons measured by elemental analysis (EA).

Sample	C (wt.%)	H (wt.%)	N (wt.%)	S (wt.%)	O (wt.%) [*]
cA-T	94.8	1.4	0.3	0	3.5
cA-Vm-T	93.7	0.7	0.5	0	5.1
cA-Tm	94.4	0.4	0.8	0	4.4
cA-Vm-Tm	94.2	0.5	0.8	0	4.5

* The oxygen content was obtained by difference

Table S2. Surface chemistry of the 3D-printed carbon obtained by XPS.

Sample	C (at.%)	O (at.%)
cA-T	93.6	6.4
cA-Vm-T	92.2	7.8
cA-Tm	93.3	6.7
cA-Vm-Tm	91.6	8.4

Table S3. Peak assignments, relative contributions and binding energies (BE) of surface functional groups obtained by XPS.

Sample	C1s					O1s			
	C-I	C-II	C-III	C-IV	C-V	O-I	O-II	O-III	O-IV*
	Area [BE] (% [eV])	Area [BE] (% [eV])	Area [BE] (% [eV])	Area [BE] (% [eV])	Area [BE] (% [eV])	Area [BE] (% [eV])	Area [BE] (% [eV])	Area [BE] (% [eV])	
cA-T	66.1 [284.4]	20.6 [285.5]	4.6 [287.4]	6.1 [289.1]	2.7 [290.1]	67.7 [531.4]	15.4 [533.5]	16.9 [535.9]	
cA-Vm-T	61.6 [284.5]	27.6 [285.5]	8.7 [287.5]	0.8 [289.1]	1.3 [290.1]	22.2 [531.1]	69.2 [532.7]	14.9 [534.5]	
cA-Tm	63.1 [284.4]	26.5 [285.5]	7.0 [287.5]	0.9 [289.1]	2.4 [290.2]	26.8 [531.3]	58.7 [532.7]	8.6 [534.5]	5.9 [536.6]
cA-Vm-Tm	58.9 [284.4]	32.2 [285.6]	7.9 [287.5]	0.8 [289.1]	1.1 [290.2]	18 [531.8]	78.5 [532.9]	3.5 [535.1]	

* Corresponding to adsorbed H₂O and adsorbed O₂ [1]

Figure S2. (a) C1s and (b) O1s XPS spectra of the 3D-printed carbon samples.

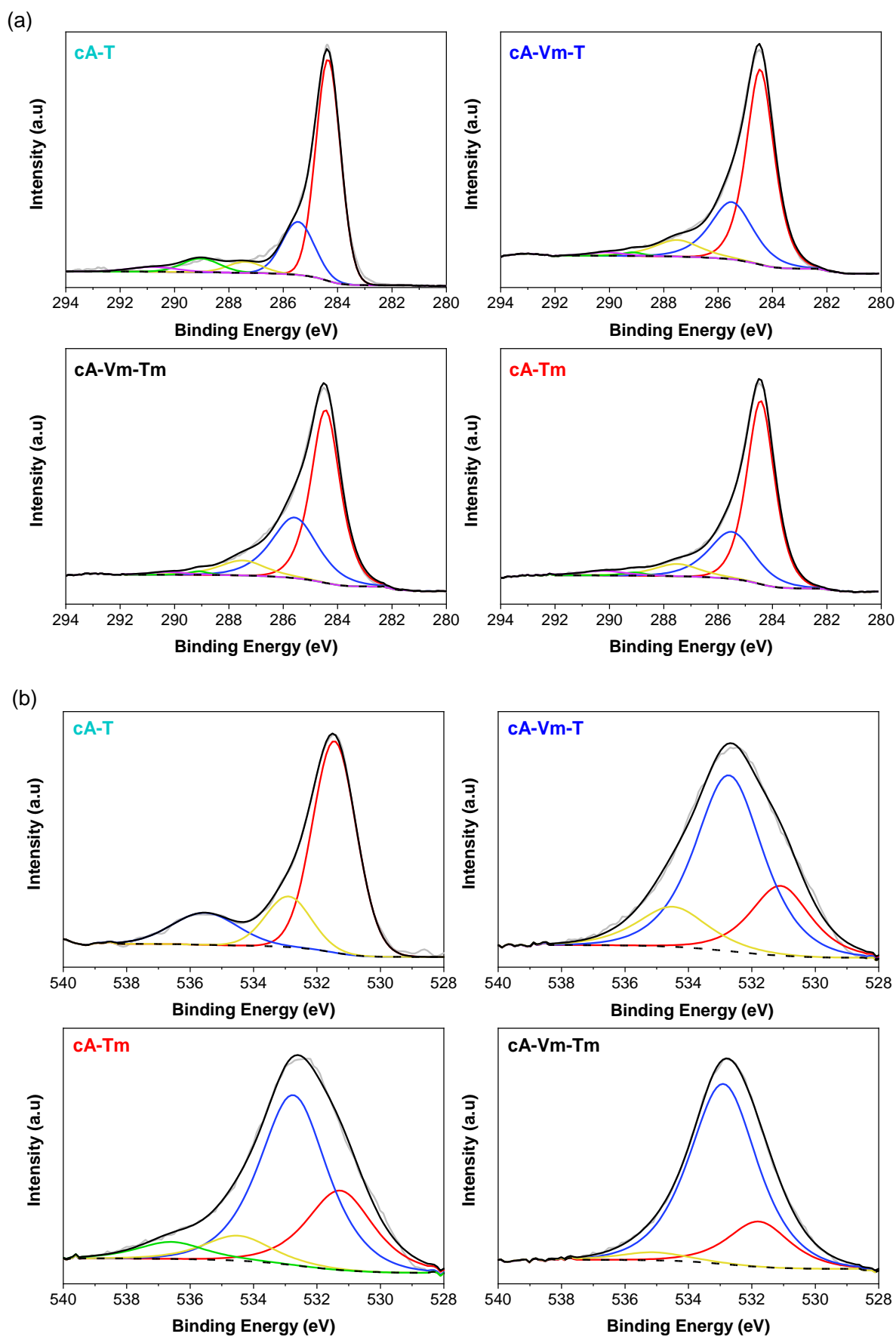


Table S4. BET area and performance of the materials of this study and others reported in the literature.

Names of the samples correspond to those of their reference source.

Sample	Commentary	A_{BET} ($\text{m}^2 \text{g}^{-1}$)	Rev cap. (mAh/g)	Ref.
HC80+150°C	Phloroglucinol-glyoxylic acid resin	7.9	270	[2]
HC-MC	Hard carbon derived from mimosa extract	1.5	345.3	[3]
HC1600	Tannin foam	49	306	[4]
This work		3-54		

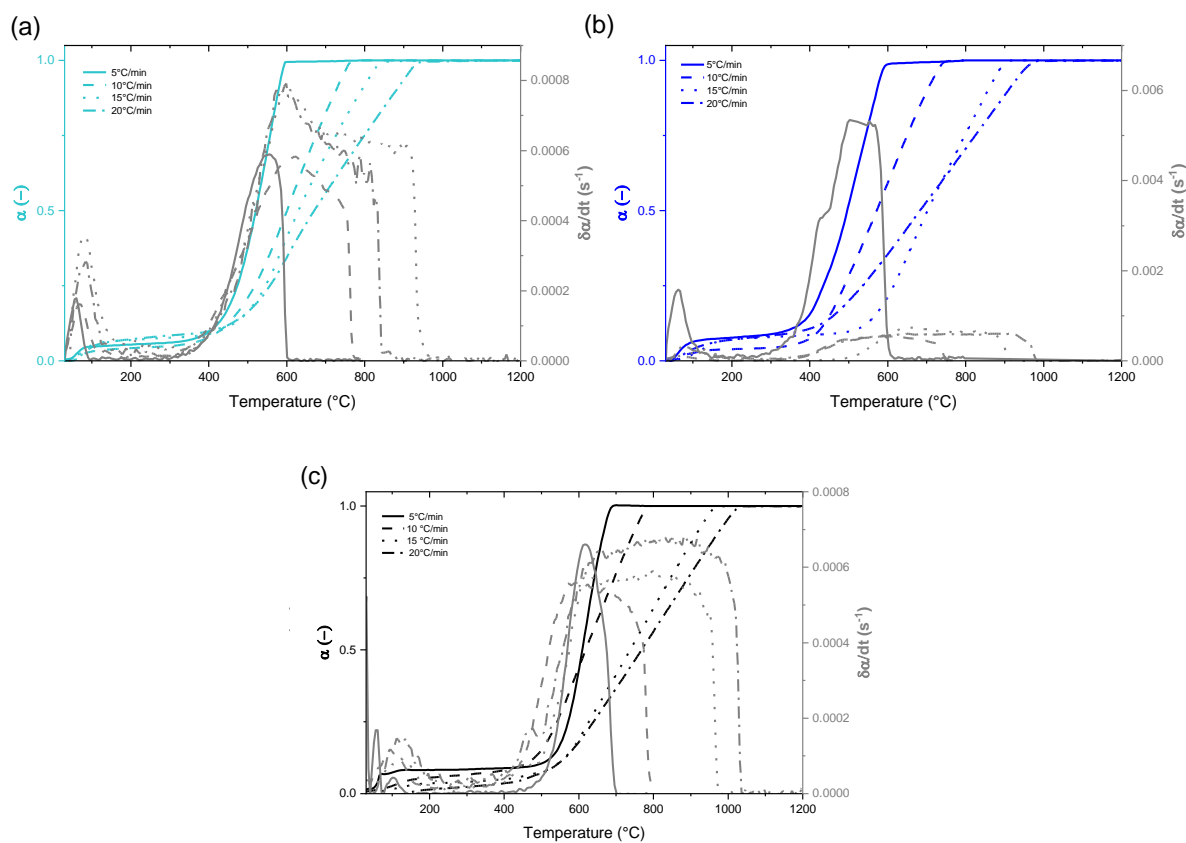


Figure S3. Conversion and reaction rate curves versus temperature for the samples (a) cA-T; (b) cA-Vm-T; and (c) cA-Vm-Tm, at different heating rates.

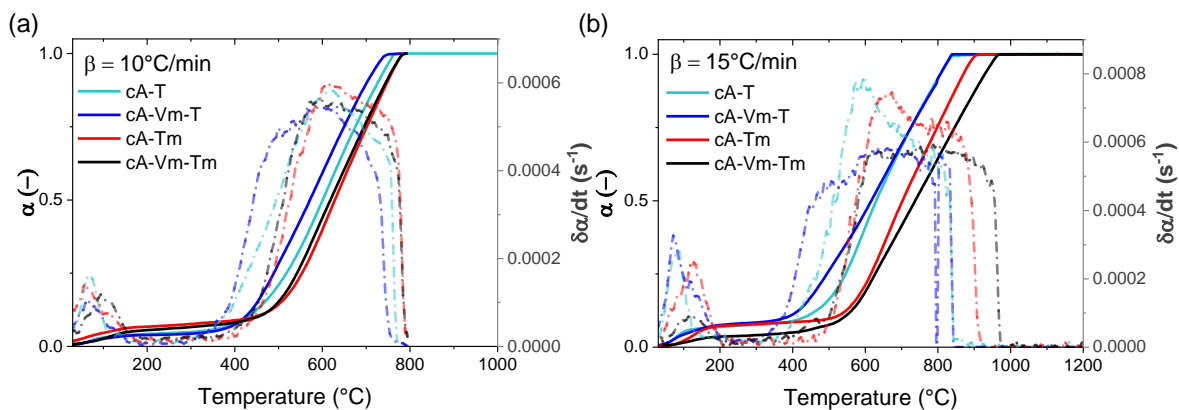


Figure S4. Conversion and reaction rate curves versus temperature for the 3D-printed carbon at (a) 10 K min⁻¹, and (b) 15 K min⁻¹.

Table S5. Activation energies for the oxidation of the 3D-printed carbons, obtained by the KAS method.

Sample	E_a (kJ mol ⁻¹)
cA-T	76
cA-Vm-T	57
cA-Tm	49
cA-Tm-Vm	38

Table S6. Main mechanical properties of the 3D-printed carbons from this study.

Sample	Compressive strength (MPa)	Strain at break (%)	Young's modulus (MPa)
cA-T	4.3 ± 1.1	1.67 ± 0.3	205 ± 1.0
cA-Vm-T	8.3 ± 1.5	3.88 ± 0.3	350.7 ± 3.3
cA-Tm	7.7 ± 0.5	3.4 ± 0.1	301.7 ± 1.3
cA-Vm-Tm	6.7 ± 0.9	2.7 ± 0.2	387 ± 8.4

Table S7. Electrical conductivity of the pyrolysed 3D-printed structures, depending on the initial resin formulation.

Sample	Electrical conductivity ($\text{S}\cdot\text{cm}^{-1}$)	Estimated skeleton conductivity ($\text{S}\cdot\text{cm}^{-1}$)
cA-T	6.77	47.91
cA-Vm-T	10.50	38.32
cA-Tm	9.76	42.94
cA-Vm-Tm	14.65	54.47

References

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