Graphene entanglement in mesoporous resorcinol-formaldehyde matrix applied to the nanoconfinement of $LiBH_4$ for hydrogen storage

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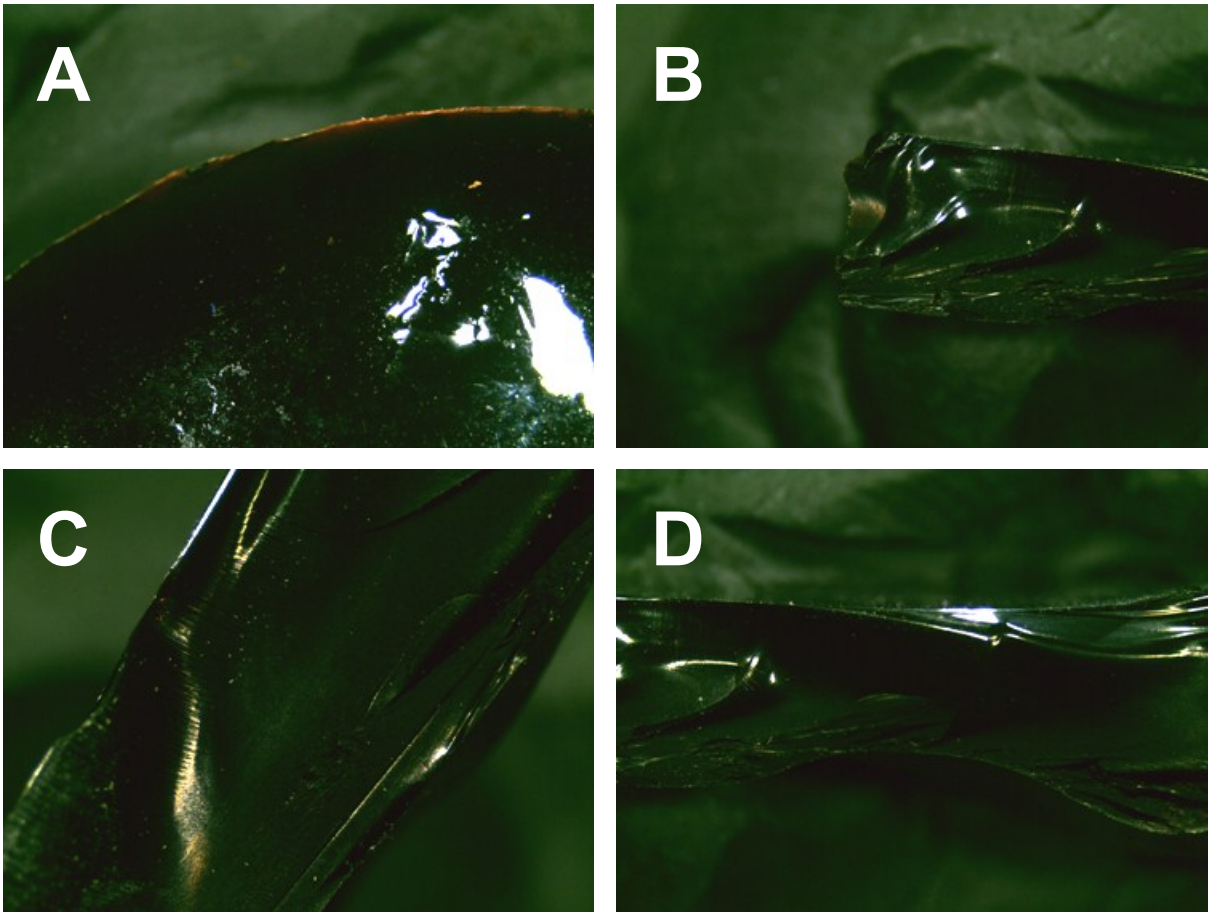
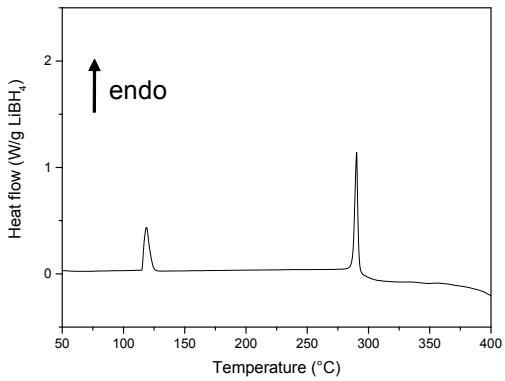
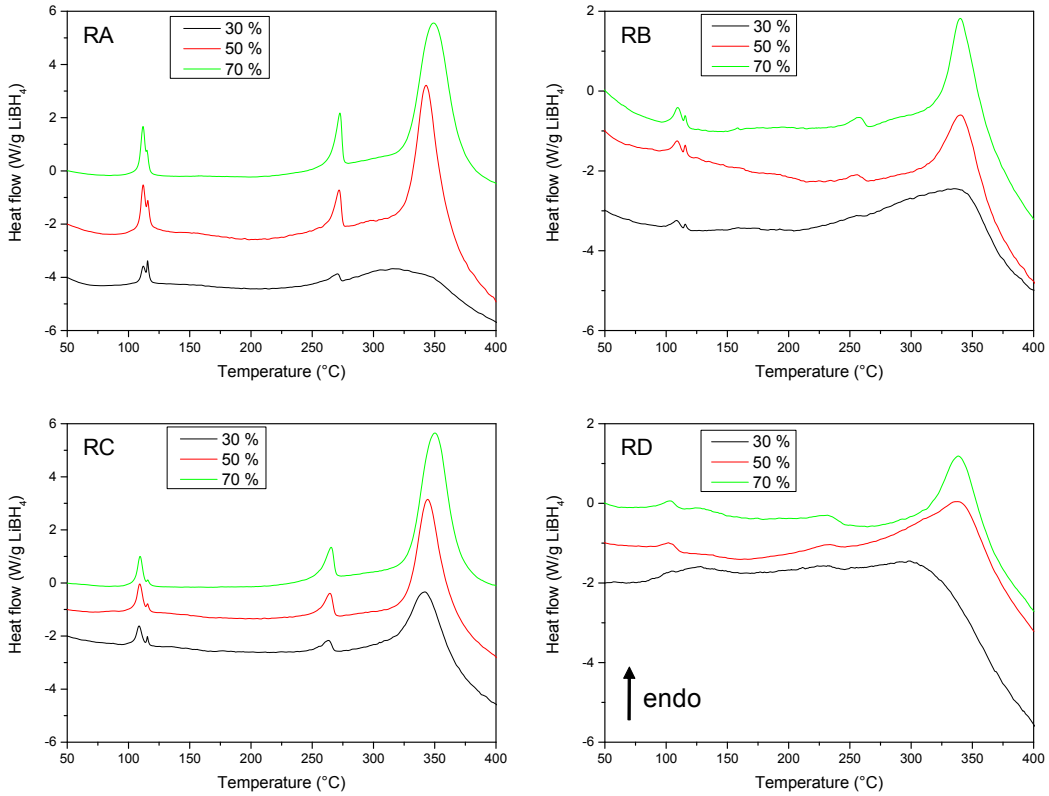
SUPPLEMENTARY INFORMATIONS



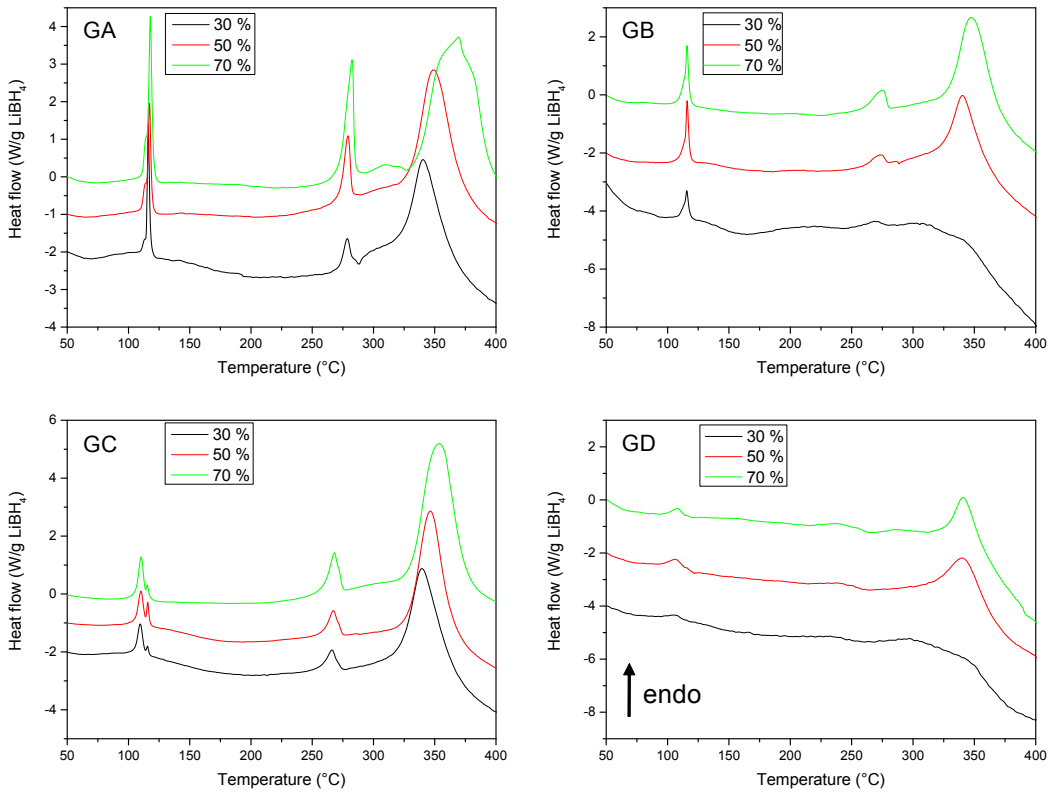
S. I. 1 Digital pictures of GRFB samples before pyrolysis observed at x20 magnification, top view (A) or fractured views (B, C, D). The graphene backbone (black) is present in the majority of the sample volume, but small RF dominions (red) can be distinguished within the fractures by transparency.



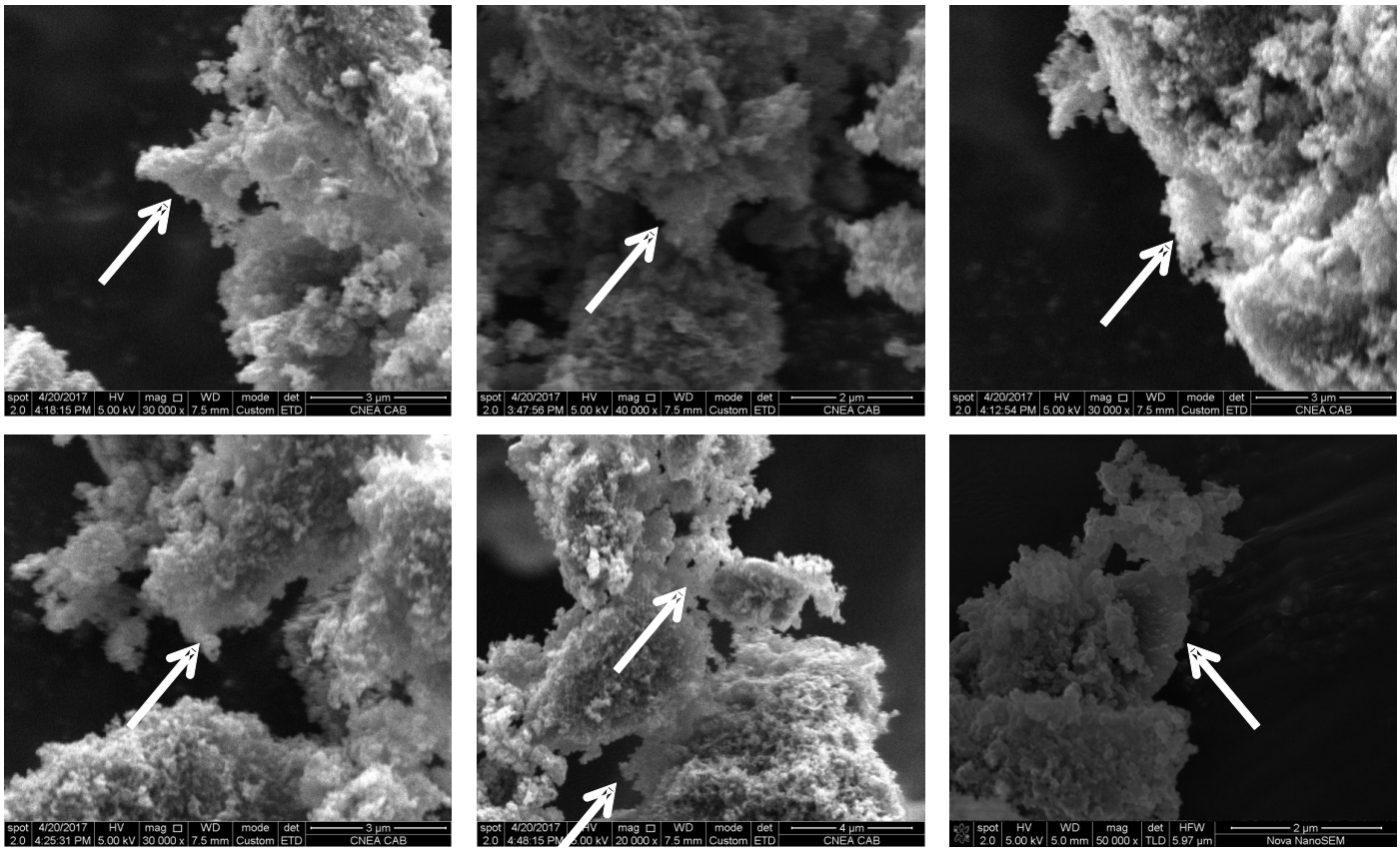
S. I. 2. DSC plot of bulk $LiBH_4$



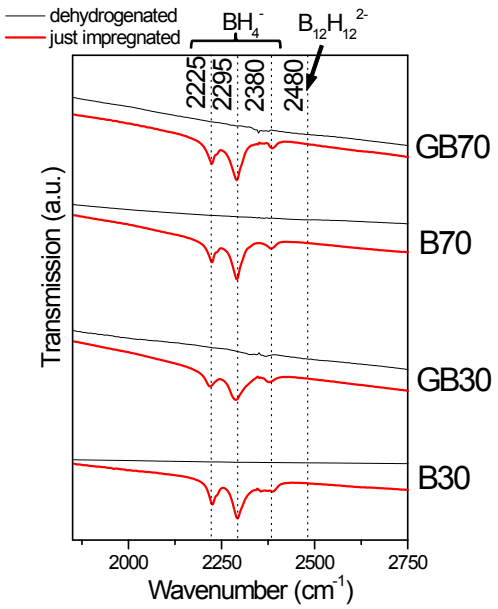
S. I. 3. DSC plots of nanoconfined $LiBH_4$ in reference resins



S. I. 4. DSC plots of nanoconfined $LiBH_4$ in resins with graphene



S. I. 5 SEM images of GRFB. Arrows indicate the graphene backbone



S. I. 6 FT-IR spectra of solid samples B and GB just after filling (red) with $LiBH_4$, and after a cycle of desorption/adsorption/desorption (black). While the just impregnated samples show the characteristic bands of BH_4^-, after cycling those bands are absent and the characteristic band of the $[B_{12}H_{12}]^{2-}$ species is also absent. This confirms that the dehydrogenation was complete without formation of $Li_2B_{12}H_{12}$.

Matrix	**Filling capacity v/v (%)**	**Filling capacity wt/wt**	**Temperature at 1% released H_2 (°C)**	**Slope at 1% ±5°C (%/10°C)**	**Desorbed H_2 at 325 °C (wt%)**	**Slope at 325±5°C (%/10°C)**
Bulk	-	"1.000"	337	0.298	0.65	0.259
RFB	30	0.115	256	0.397	6.49	1.142
	70	0.230	269	0.324	4.86	1.271
GRFB	30	0.167	259	0.374	7.01	1.254
	70	0.330	280	0.381	4.30	1.145
RFD	30	0.088	249	0.400	7.16	1.057
	70	0.184	263	0.370	6.08	1.358
GRFD	30	0.120	253	0.367	6.80	1.180
	70	0.242	272	0.345	4.70	1.220

S. I. 7. Extraction of numerical values from desorption curves

Value	**Filling (F)**	**Graphene (G)**	**Matrix (M)**
-1	30	NO	D
+1	70	YES	B

S. I. 8. Normalisation of experimentalvariables

Output	Average	F	G	M	FxG	GxM	FxM	FxGxM
Filling capacity wt/wt	0.1845	0.062	0.0302	0.026	0.0092	0.0077	0.0075	0.0027
Temperature at 1% released H_2 (°C)	262.62	8.37	3.37	3.37	1.62	0.12	0.12	0.37
Desorbed H_2 at 325 °C (wt%)	5.92	-0.94	-0.22	-0.26	-0.26	0.21	-0.14	-0.01

S. I. 9. Application of Yates analysis to desorption curves (see S. I. 5 for abbreviation) to determine the influence of each factor and possible interaction effects.