Design of a technical Mg-Al mixed oxide catalyst for the continuous manufacture of glycerol carbonate

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Table S1. Characterisation data of the catalysts screened in this study.

Catalyst	S_{BET} [a] / $m^2\ g^{-1}$	V_{pore} [b] / $cm^3\ g^{-1}$	C_B [c] / $\mu mol\ g^{-1}$
CaO	15	0.30	65
MgO	23	0.21	100
ZnO	82	0.41	84
ZnHT-c823	189	0.59	890
ZnZ40	420	0.20	213
γ-Al_2O_3	69	0.45	64
Y-AT	430	0.27	439

[a] BET method; [b] volume adsorbed at $p/p_0 = 0.98$; [c] CO_2-TPD.

Table S2. Chemical composition and catalytic performance of the binders.

Binder	Mg wt.%	Al wt.%	Si wt.%	K wt.%	Ca wt.%	Ti wt.%	Fe wt.%	Y_{GC} [a] %
Attapulgite	8.3	5.4	30.8	0.7	2.4	0.4	4.1	17
Silica	0.0	0.1	46.6	0.0	0.0	0.0	0.0	9
Alumina	0.0	52.3	0.5	0.2	0.0	0.0	0.0	19
Kaolin	0.4	17.5	29.4	0.2	0.0	1.3	0.7	15
Bentonite	4.0	8.3	32.0	0.1	1.8	0.4	4.3	23

[a] Reaction conditions: $T = 423$ K, $P = 10$ mbar, $t = 1$ h, $n_{glycerol}/n_{urea} = 1$, $m_{cat}/m_{glycerol} = 0.1$.

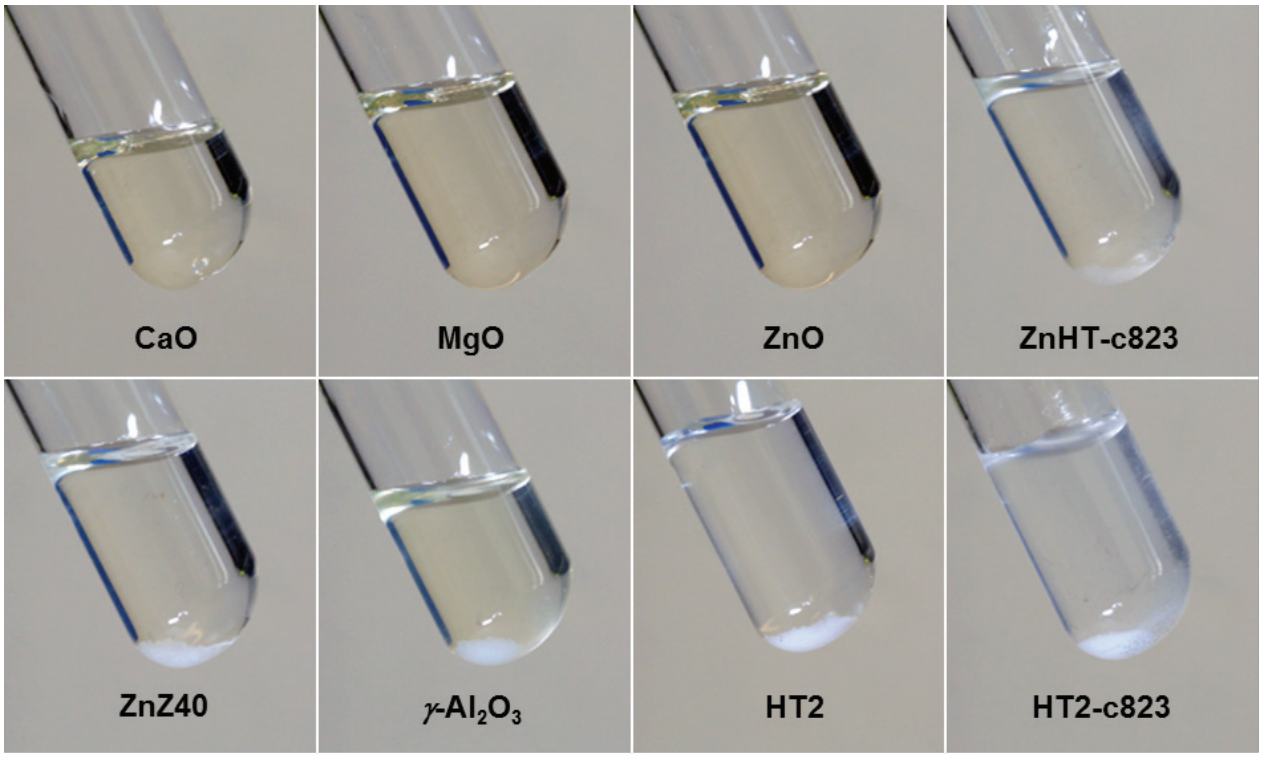

Figure S1. Photographs of the reaction mixtures collected at the end of the catalytic tests showing the complete dissolution of CaO, MgO and ZnO. Reaction conditions: T = 423 K, P = 10 mbar, t = 1 h, $n_{glycerol}/n_{urea}$ = 1, $m_{cat}/m_{glycerol}$ = 0.1.

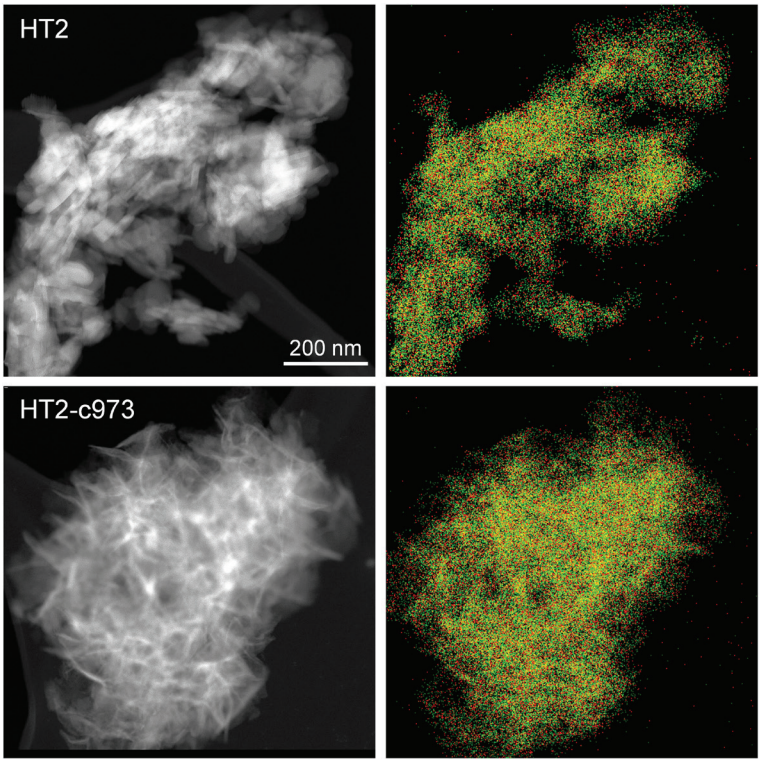

Figure S2. HAADF images and corresponding elemental maps of magnesium (green) and aluminium (red) of the as-synthesised HT2 and the calcined HT2-c973 samples. The scale bar applies to all micrographs.

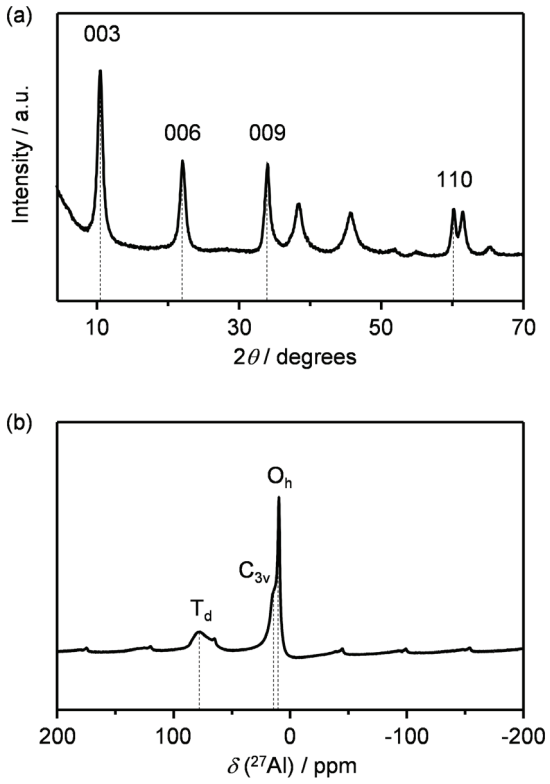

Figure S3. (a) XRD pattern and (b) ^{27}Al MAS NMR spectrum of the rehydrated HT2-c823-r sample.

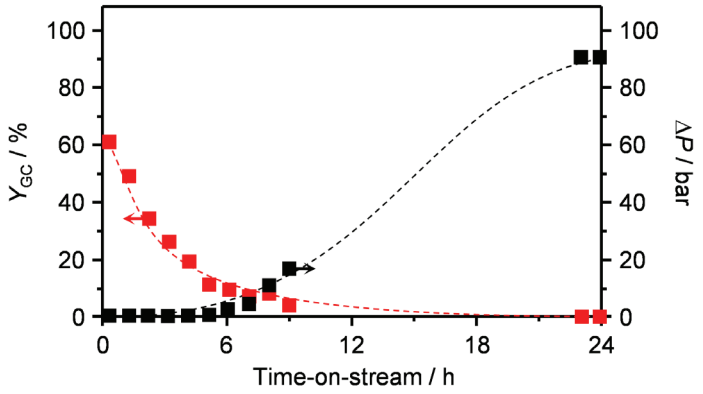

Figure S4. Glycerol carbonate yield and pressure drop over the fixed bed *versus* time-on-stream upon evaluation of the HT2-c823 catalyst in its powder form.

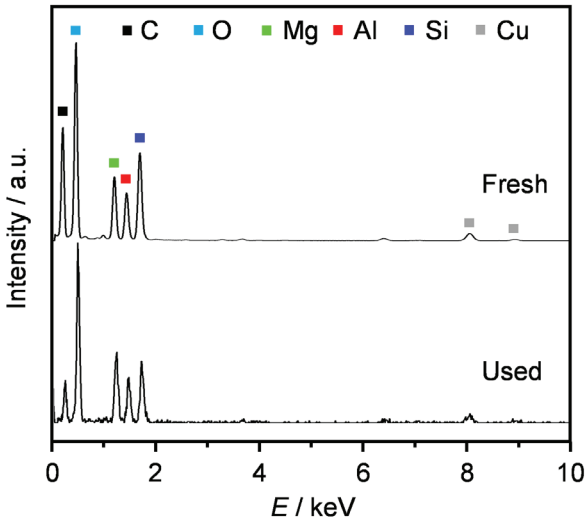

Figure S5. EDX spectra of HT2-b-c823 in its fresh and used forms.

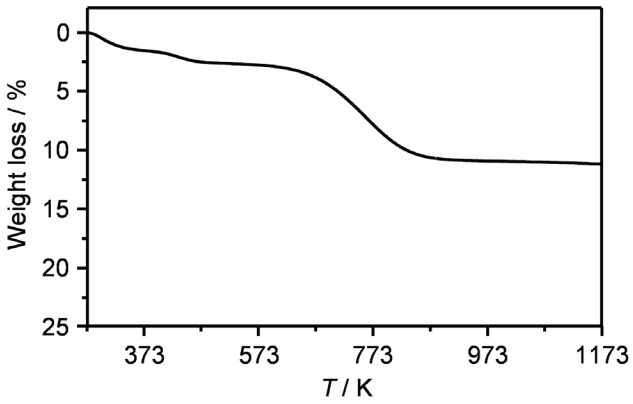

Figure S6. TGA profile of the HT2-b-c823 extrudate after the 100-h catalytic test.