

Thermo Chemical Material (TCM) Range

Thermochemical energy storage may yield a reasonable heat storage capacity without producing any thermal losses during the storage period. The working pairs of various salt options incorporated in high porous structured carrier materials whereby utilising a reversible chemical reaction and takes the advantages of strong chemical bonds to store energy as chemical potential. Compared to sensible heat storage and latent heat storage, this theoretically offers higher energy density with minimum energy loss during long-term storage due to the temperature-independent means of storage.

Following extensive development programme over the last 10 years it is established that the most critical aspect of the Thermo Chemical Material (TCM) based Thermal Energy Storage (TES) is the regeneration temperature of the TCM. Hence, the following range of TCM materials are designated based on the regeneration point.

Thermo Chemical Material	TCM-81	TCM-71	TCM-65	TCM-110	TCM-72	TCM-127	TCM-113	TCM-28	TCM-122	TCM-250
Energy Capacity (lit) (GJ/m ³) ^a	2.67	3.10	1.30	2.03	2.22	2.48	2.29	2.27	2.49	-
Dehydration Temp (deg C) ^a	81	71	65	110	72	127	113	28	122	>150 ^d
Dehydration Mechanism ^a	6 → 0	6 → 0	1.5 → 0	2 → 0	3 → 0	6 → 1	6 → 0	7 → 1	6 → 0	-
Density (hydrate)	2.0	1.5	2.0	1.6	1.5	1.5	1.5	1.7	2.4	-
Density (anhyd)	3.35	2.15	2.43	3.46	2.07	2.32	2.30	2.66	4.22	-
Energy Capacity per kg (kJ/kg) ^c	797	1442	535	587	1072	1069	996	853	590	480 ^b
Salt loading on absorbent (as anhyd) (%) ^d	73.5	68	62	70	57	40	54	46	67	-
Bulk Density of salt/absorbent TCM (dry) ^d	0.375	0.221	0.215	0.307	0.217	0.221	0.249	0.200	0.297	0.64
Energy Density (kJ/l) ^e	220	217	71	126	133	94	134	78	117	307
Energy Density (kWh/m ³)	61	60	20	35	37	26	37	22	33	85
Energy Density (RT-h/USG)	0.066	0.065	0.021	0.038	0.040	0.028	0.040	0.023	0.035	0.092
Energy Density (Btu/USG)	789	778	256	453	476	339	481	282	421	1102
TCM bulk material cost (£GBP)/lt)	4.92	1.54	2.40	23.76	18.27	1.33	1.50	1.43	9.72	2.88
TCM bulk material cost (US\$/lt)	6.15	1.92	3.00	29.71	22.84	1.66	1.88	1.79	12.15	3.60
TCM bulk material cost (US\$/USG)	23.30	7.28	11.36	112.52	86.50	6.30	7.11	6.77	46.02	13.64
TCM bulk material cost (€/Euro)/lt)	5.66	1.77	2.76	27.33	21.01	1.53	1.73	1.64	11.18	3.31
Energy density cost (£GBP)/kWh)	80.64	25.55	121.14	678.20	496.01	50.66	40.39	65.56	298.01	33.77
Energy density cost (US\$/RT-h)	354.83	112.43	533.00	2984.07	2182.46	222.93	177.72	288.45	1311.24	148.60
Energy density cost (US\$/MBtu)	1561.27	494.69	2345.21	13129.92	9602.81	980.87	781.95	1269.19	5769.46	653.83
Energy density cost (€/Euro)/kWh)	106.65	33.79	160.20	896.92	655.98	67.00	53.42	86.70	394.12	44.66

Notes;

a = <http://dx.doi.org/10.1016/j.apenergy.2017.04.080>

b = <http://dx.doi.org/10.1016/j.enconman.2017.03.080>

c = energy capacity (GJ/m³) / density (anhyd)

d = exptal data but ideally one has to closer to 250C levels for safe operation

e = (energy capacity (kJ/kg) x salt loading (%) x bulk density) / 100

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