Electronic Supplemental Information for:

A Thermal Energy Storage Prototype using Sodium Magnesium Hydride

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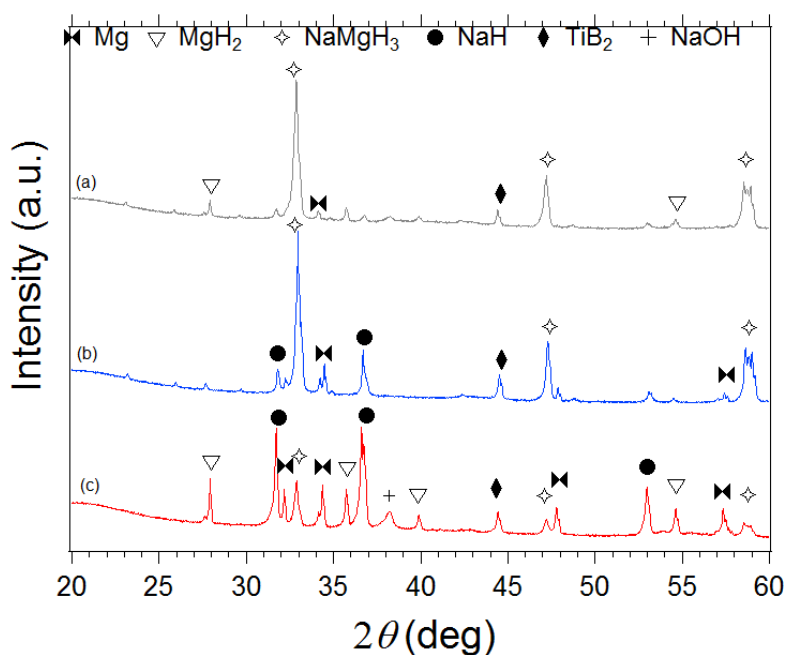* email: terry_humphries81@hotmail.com

Figure S1. X-ray diffraction pattern of synthesised $NaMgH_3$ after milling and annealing. (a) Ball-milled with a MgH_2 precursor, (b) Ball-milled with a Mg precursor, (c) hand-ground with a Mg precursor.

XRD patterns of the $NaMgH_3$ sample after cycling shows (Figure S2) that it remains stable, with minor formation of MgO (< 5 wt%). There is also a higher yield of $NaMgH_3$ after cycling (89 %) demonstrating that cycling under these temperature and pressure conditions is sufficient.
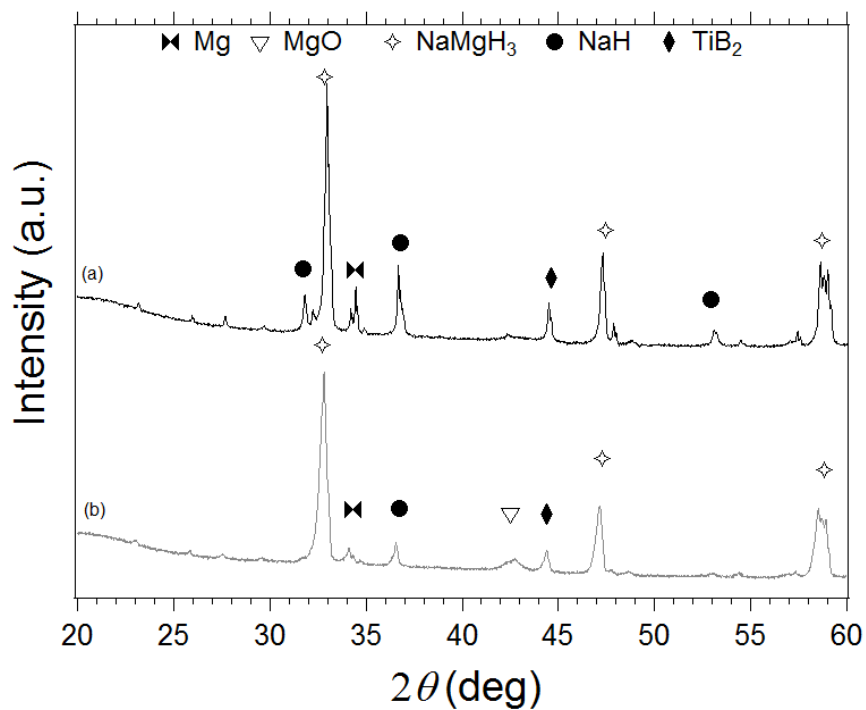
Figure S2. X-ray diffraction pattern of NaMgH$_3$ (and 2 mol% TiB$_2$) (a) before and (b) after cycling 30 times between 400 °C and 465 °C.
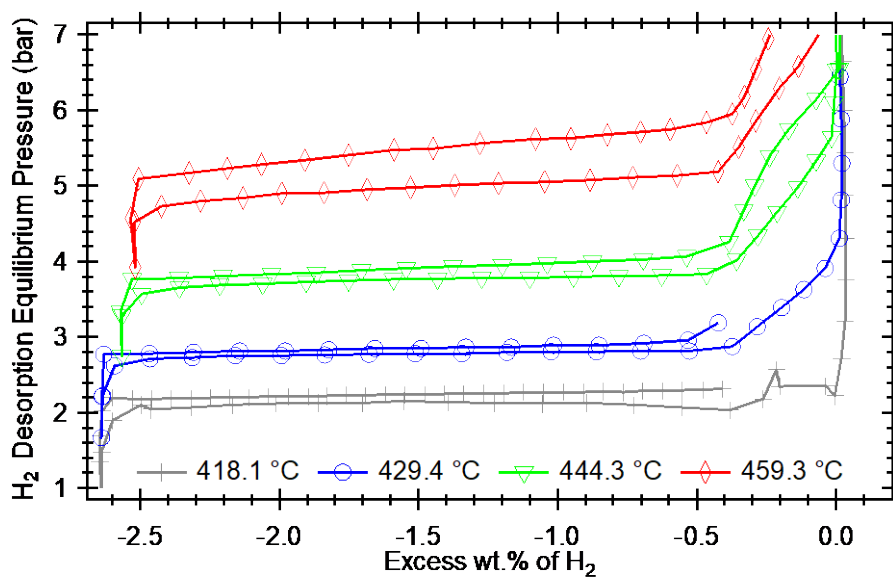

Figure S3. Pressure-Composition-Isotherms, absorption (top) and desorption (bottom), of reactor mix showing desorption and the following absorption.

A Van't Hoff plot is illustrated in Figure S3 by reporting the natural logarithm of the hydrogen pressure for 1.5 wt% of desorption over the inverse of temperature. A linear fit to the data allows the calculation of the entropy and enthalpy of formation.
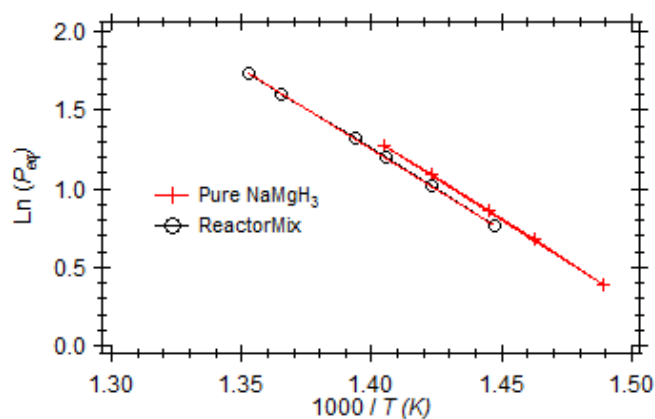

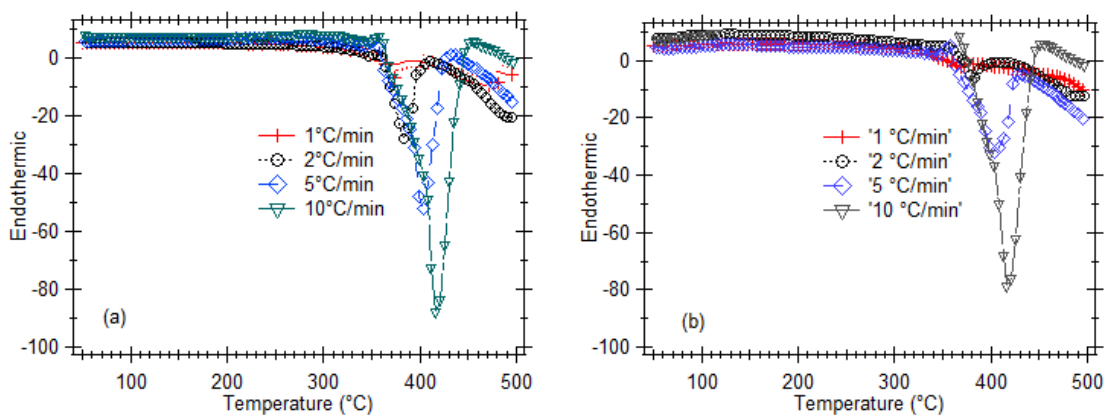**Figure S4**. Van't Hoff plot for pristine NaMgH$_3$ and reactor mix.

Figure S5. Differential scanning calorimetry of pristine (a) NaMgH$_3$ and (b) reactor mix, for different heating rates.
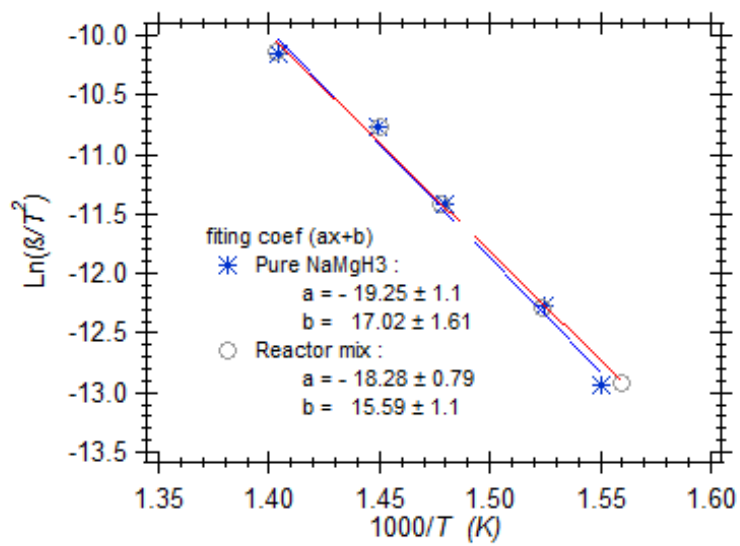
Figure S6. Kissinger plot for pure NaMgH$_3$ (blue stars), and reactor mix (black circle).