

CALCIUM NITRIDE HYDRIDE FOR THERMAL STORAGE

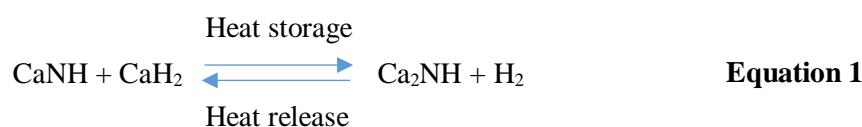
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Cost-effective energy storage is one of the biggest problems for renewable energy, which is due to the fluctuating supply of the intermittent and unpredictable nature of renewables. Reversible calcium nitride hydride as thermal storage technology complement with concentrated solar power (CSP) could be one of the key pillar to solve this demanding problem. Such storage system could enable 24/7 power generation by night and on cloudy days with high cyclic stability and long lifetimes.^[1]



Next generation CSP operation temperatures will be up to 600-800 °C, as increasing temperature thermal efficiency goes up drastically and system expenditures decrease dramatically.^[2] Reversible calcium nitride hydride with working temperature around 700 °C is an alternative as a thermochemical storage medium (**Equation 1**). It has advantages like roughly 5-10 times higher volumetric density than state-of-the-art molten salts and theoretically unlimited lifecycle.^[3] However, higher than 450 °C hydrogen permeability, embrittlement and corrosion of stainless steel reactor is another challenge in this field. To our knowledge, the highest operation temperature of commercial sieverts instrument is up to 550 °C. Therefore, homemade 800 °C sieverts reactor been designed to overcome these issues. The system of Ca-N-H has not been systemically explored yet. Herein, this study carried out specific investigations on thermodynamic properties and long-term behaviours of Ca-N-H.

References

- [1] Manickam, K., Mistry, P., Walker, G., Grant, D., Buckley, C. E., Humphries, T. D., Paskevicius, M., Jensen, T., Albert, R., Peinecke, K., Felderhoff, M., *Int. J. Hydrog. Energy* **2019**, *44* (15), 7738-7745.
- [2] Skumanich, A., *Renew. Energy Focus* **2010**, *11* (5), 40-43.
- [3] Pardo, P., Deydier, A., Anxionnaz-Minvielle, Z., Rougé, S., Cabassud, M., Cognet, P., *Renew. Sust. Energ. Rev.* **2014**, *32*, 591-610.



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