Development of hydrogen compressors

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doi: 10.5937/MESCIS26021G

1. Introduction

As the world shifts toward a decarbonized energy landscape, hydrogen has emerged as a critical vector for clean energy storage and transport. However, because of hydrogen's extremely low volumetric density, efficient and reliable compression is essential for its practical deployment. The thermal driven (TD) hydrogen compression is the technique with its advantages (no moving parts, potentially better reliability and endurance) but also drawbacks, such as low efficiency and external heat dependence, which can be compensated with industrial waste heat [1][2].

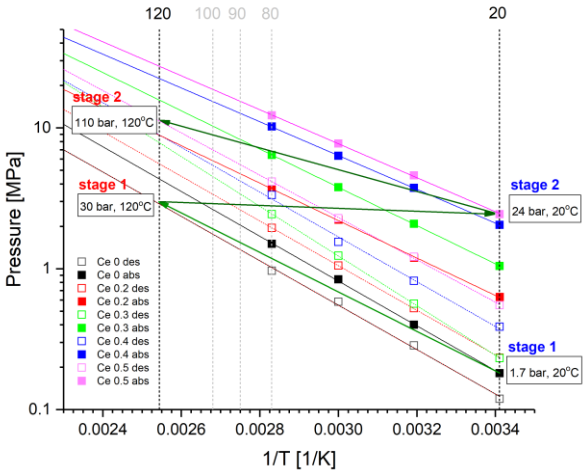


Figure 1. Possible hydrogen sorption path for two stage thermal driven compressor with Ce doped AB5 active material.

We are committed to development of hybrid system with hydrogen storage plus two stage thermal driven compression system with output pressure up to 110 bars. The compression stage is based on AB5 active material. The storage stage is metal hydride based with desorption pressure sufficient to drive stage 1 with initial pressure of 1.7 bar as 20°C. By subsequent heating of the stage 1, transferring hydrogen to low temperature stage 2 and heating of the stage 2, output pressure is set desired value. A half cycle system has been constructed, meaning the hydrogen supply is possible only when the stage 2 is in heating stage. In the prospect we are planning the development of full cycle system with additional two “mirror” stages operating in opposite heating/cooling phases, thus enabling the continual supply of hydrogen.

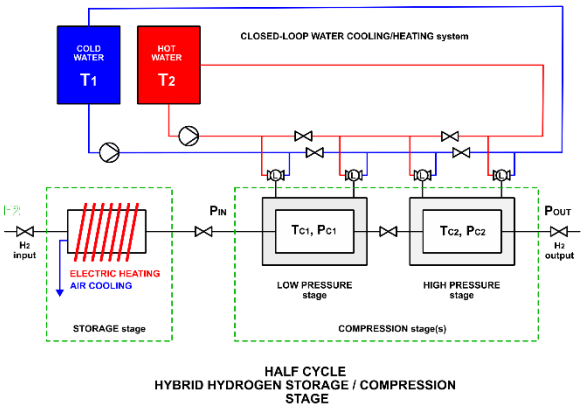


Figure 2. Block diagram of half-phase hybrid hydrogen storage/compression system.

References

[1] M.V. Lototskyy, V.A. Yartys, B.G. Pollet, R.C. Bowman Jr.d, Int J Hydrogen Energy. 39(11) (2014) 5818. https://doi.org/10.1016/j.ijhydene.2014.01.158

[2] R. Bowman, B. Smith, L. Anovitz, US DOE Hydrogen Fuel Cell Annual Merit Review, 2019

Acknowledgment

This work is supported by SPS NATO G6037 project.



Dr. Jasmina Grbović Novaković has made significant contributions to the 'Vinča' Institute and the Republic of Serbia through her research in hydrogen energy materials, playing a key role in laying the foundation for the nation's energy transition. Through the establishment of the Center of Excellence (CONVINCE) and a joint Chinese-Serbian laboratory, she enhanced the Institute's research capabilities, positioning it as a regional center for renewable energy. Her professional portfolio highlights her participation in drafting Serbia's Hydrogen Energy Development Strategy and Montenegro's Green Hydrogen Strategy project.
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