Magnetocaloric Hydrogen Liquefaction

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ABSTRACT

Magnetocaloric hydrogen liquefaction (MCHL) is a thriving area of research and will contribute to reaching the ambitious goals set forth by the European Commission: an energy demand of 8 kWh/kgH_2 and a liquefaction cost of <1.5 €/kgH_2. MCHL offers the following perspectives: i) Increased energy efficiency of >20% for small liquefaction volumes of <5 ton per day (TPD) and up to 50 % for >5 TPD; ii) Reduced capital expenditures (CAPEX) and operating expenses (OPEX) by at least 20 % in addition to the targeted energy savings; iii) Decentralized (local) production of liquid hydrogen (LH2), thus reducing the need for distribution and transport across long distances; iv) Coupling of the MCHL technology to hydrogen production from renewables (green hydrogen) for off-grid configurations; v) Integration into conventional liquefaction plants to increase their overall energy efficiency; vi) Application of the process for the liquefaction of hydrogen and for boil-off management of LH2 tanks. To make MCHL commercially viable, several obstacles related to materials and heat management must be overcome. The research carried out in the framework of *HYDROGENi* is centered around the development of novel high-performant magnetic materials as well as improving the efficiency of the liquefaction process. Selected highlights of the first 18 months are summarized in this presentation.

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