Heat exchanger selection and design analyses for metal hydride heat pump systems - DTU Orbit (09/11/2017)

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This study presents a design analysis for the development of highly efficient heat exchangers within stationary metal hydride heat pumps. The design constraints and selected performance criteria are applied to three representative heat exchangers. The proposed thermal model can be applied to select the most efficient heat exchanger design and provides outcomes generally valid in a pre-design stage. Heat transfer effectiveness is the principal performance parameter guiding the selection analysis, the results of which appear to be mildly (up to 13%) affected by the specific Nusselt correlation used. The thermo-physical properties of the heat transfer medium and geometrical parameters are varied in the sensitivity analysis, suggesting that the length of independent tubes is the physical parameter that influences the performance of the heat exchangers the most. The practical operative regions for each heat exchanger are identified by finding the conditions over which the heat removal from the solid bed enables a complete and continuous hydriding reaction. The most efficient solution is a design example that achieves the target effectiveness of 95%.

General information

State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Sandia National Laboratories, Purdue University
Authors: Mazzucco, A. (Intern), Voskuilen, T. G. (Ekstern), Waters, E. L. (Ekstern), Pourpoint, T. L. (Ekstern), Rokni, M. (Intern)
Pages: 4198-4213
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: International Journal of Hydrogen Energy
Volume: 41
Issue number: 7
ISSN (Print): 0360-3199
Ratings:

BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.74 SJR 1.142 SNIP 1.286
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.294 SNIP 1.319 CiteScore 3.46
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.212 SNIP 1.494 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.278 SNIP 1.467 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.515 SNIP 1.729 CiteScore 3.96
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.456 SNIP 1.837 CiteScore 4.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.589 SNIP 1.871
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.333 SNIP 1.885

Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.401 SNIP 2.096
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.279 SNIP 2.201
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.073 SNIP 2.161
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.107 SNIP 1.787
Scopus rating (2004): SJR 1.225 SNIP 1.626
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.003 SNIP 1.319
Scopus rating (2002): SJR 0.763 SNIP 1.157
Scopus rating (2001): SJR 0.487 SNIP 1.185
Scopus rating (2000): SJR 0.518 SNIP 0.866
Scopus rating (1999): SJR 0.382 SNIP 0.897
Original language: English
Metal hydride heat pump, Metal hydride, Heat exchanger, Thermal analysis, Sensitivity analysis
DOIs:
10.1016/j.ijhydene.2016.01.016
Source: FindIt
Source-ID: 2291710681
Publication: Research - peer-review › Journal article – Annual report year: 2016