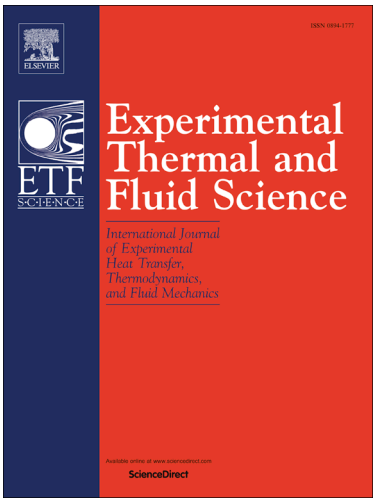

Experimental investigation on the impingement characteristics of a self-excited oscillation pulsed supercritical carbon dioxide jet

Man Huang, Yong Kang, Xiaochuan Wang, Yi Hu, Deng Li, Can Cai, Yiwei Liu

PII: S0894-1777(18)30201-2
DOI: https://doi.org/10.1016/j.expthermflusci.2018.02.015
Reference: ETF 9376

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 29 August 2017
Revised Date: 31 January 2018
Accepted Date: 10 February 2018

Please cite this article as: M. Huang, Y. Kang, X. Wang, Y. Hu, D. Li, C. Cai, Y. Liu, Experimental investigation on the impingement characteristics of a self-excited oscillation pulsed supercritical carbon dioxide jet, *Experimental Thermal and Fluid Science* (2018), doi: https://doi.org/10.1016/j.expthermflusci.2018.02.015

Experimental investigation on the impingement characteristics of a self-excited oscillation pulsed supercritical carbon dioxide jet

Man Huang [a,b,c], Yong Kang [a,b,c], Xiaochuan Wang [a,b,c,*], Yi Hu [a,b,c], Deng Li [a,b,c], Can Cai [a,b,c] and Yiwei Liu[a,b,c]

a Key Laboratory of Hydraulic Machinery Transients, Ministry of Education, Wuhan University, Wuhan 430072, China
b Hubei Key Laboratory of Waterjet Theory and New Technology, Wuhan University, Wuhan 430072, China
c School of Power and Mechanical Engineering, Wuhan University, Wuhan 430072, China
* Corresponding author at: School of Power and Mechanical Engineering, Wuhan University, Wuhan 430072, China.
E-mail address: xcw001@whu.edu.cn (X. Wang).

Abstract Supercritical carbon dioxide (SC-CO_2) jet is now widely considered to have good potential for use in the field of oil-gas exploration and development due to the unique natural properties of SC-CO_2 fluid, and because it offers many advantages over a water jet in various applications. In order to take better advantage of the SC-CO_2 jet, a jet-driven Helmholtz oscillation nozzle was applied to produce a self-excited oscillation pulsed SC-CO_2 jet (SOPSJ). The impingement characteristics of the SOPSJ were investigated experimentally with respect to the impinging pressure oscillation peak and amplitude, as well as the oscillating frequency. A preliminary theoretical exploration of the relationship between the oscillation characteristics and the unique properties of the SC-CO_2 fluid was performed. Numerous impinging pressure tests were conducted with the use of different chamber lengths of Helmholtz nozzle under inlet pressures of 25, 30, 35 and 40 MPa, ambient pressures of 10 MPa, and fluid temperature of 330K. The results show that compared with the continuous jet the SOPSJ has a greater impinging pressure peak. However, this only happens within a relatively small range of standoff distance depending on the chamber length and the inlet pressure. The maximum peaks are approximately 1.33, 1.29, 1.25 and 1.19 times those of the continuous jets corresponding to inlet pressures of 25, 30, 35, and 40 MPa, respectively. Moreover, the optimal chamber length for obtaining the maximum impinging pressure oscillation peak always leads to the largest amplitude under each inlet pressure. However, this is not true for the other chamber lengths that deviate from the optimal one. In addition, the increase in inlet pressure can cause relatively high dominant frequencies, and the frequency distribution range of the SOPSJ is close to that of the pulsed air-water jet but far from that of the self-excited oscillation pulsed water jet (SOPWJ).

Keywords: supercritical carbon dioxide jet; self-excited oscillation; pulsed; impingement characteristics; Helmholtz nozzle