

研究生:	劉博文
研究生(英文姓名):	Po-Wen Liu
論文名稱:	考量實際壓縮機性能之自然冷媒CO ₂ /NH ₃ 二元式冷凍系統最佳二元冷凝器冷凝溫度之研究
英文論文名稱:	Thermodynamic Analysis of Optimum Condensing Temperature of Cascade-Condenser
指導教授:	李宗興
指導教授(英文姓名):	Tzong-Shing Lee
學位類別:	碩士
校院名稱:	國立臺北科技大學
系所名稱:	冷凍空調工程系所
學號:	90458523
學年度:	93
語文別:	中文
論文頁數:	49
關鍵詞:	二元式冷凍系統；自然冷媒；二氧化碳；氨
英文關鍵詞:	cascade system ; natural refrigerants ; CO ₂ ; NH ₃
被引用次數:	0

[摘要]

對於應用低溫製程於蒸發溫度範圍在-40℃至-55℃之工業冷凍系統，CO₂/NH₃二元式冷凍系統具有取代氨二級冷凍系統或製冷設備之冷媒是未來新系統或設備開發之必然趨勢，以及冷媒替代問題之根本解決之道。本文的研究自然冷媒CO₂/NH₃二元式冷凍系統，考量實際壓縮機運轉特性，以達到最大COP為準則，尋找在相同冷凍能力與之最大COP。本文所考慮的設計參數為：高溫側冷凝溫度(T_c= 30、35、40℃)、低溫側蒸發溫度(TE= -45、-50、-55℃)。分析結果顯示：對於冷凝溫度為35℃與蒸發溫度為-50℃的CO₂/NH₃二元式冷凍系統而言，其二元冷凝器最佳之冷凝溫度TE、T_c與ΔT之增加而增高，其對應之COP最大值將隨蒸發溫度TE升高而增高，隨冷凝溫度T_c及二元冷凝器熱傳

[英文摘要]

For the low-temperature applications, such as quick freezing and frozen storage of food, the required evaporating temperature is to -55℃, in which a single-stage vapor-compression refrigeration system is inadequate. Considering global environmental protection, the natural refrigeration systems has been revealed to be a complete solution to permanent alternative for fluorocarbon-based refrigeration systems. CO₂ and NH₃ fulfills these requirements for low-temperature applications of industry refrigeration. As a refrigerant are now gaining attention, the works on CO₂/NH₃ cascade refrigeration system are still lacking. This paper studies the optimum condensing temperature of the cascade-condenser in a cascade refrigeration system utilizing carbon dioxide and ammonia. The design parameters for this paper is : High temperature circuit condensing temperature (T_c= 30, 35, 40℃), low temperature circuit evaporating temperature (TE= -45, -50, -55℃), cascade condenser difference temperature (ΔT= 3, 4, 5℃). The results show that for CO₂/NH₃ cascade system with condensing temperature is 35℃ and evaporating temperature is -50℃, the cascade condenser optimum condensing temperature, T_c and ΔT will increase by the raise of TE, T_c and ΔT.

[論文目次]

摘要 i	
ABSTRACT ii	
誌謝 iv	
目錄 v	
表目錄 vii	
圖目錄 viii	
第一章 前言 1	
1.1 研究背景與動機 1	
1.2 文獻回顧 2	
1.3 研究目的 4	

第二章 冷媒特性	5
2.1 氨 (R717) 的特性	5
2.2 二氧化碳CO ₂ (R744)的特性	9
第三章 熱力分析模式	15
3.1 二元式冷凍系統介紹	15
3.2 理論模式	18
第四章 結果與討論	24
4.1 典型CO ₂ /NH ₃ 二元式系統之特性	24
4.2 冷凝溫度TC、蒸發溫度TE與二元冷凝器之熱傳溫差 ΔT 對TMCOPT之影響	37
第五章 結論	43
參考文獻	47
符號彙整	49

[參考文獻]

- [1] L. Rolfsman, "Experiences from CO₂ cascade plants," 21st International Congress of Refrigeration, Wash
- [2] J. Fleming, "Carbon dioxide as the working fluid in heating and /or cooling system," IIR Bulletin, vol. 83, no
- [3] A. Pearson, "Carbon dioxide-new uses for an old refrigerant," 21st International Congress of Refrigeration
- [4] F. Kauf, "Determination of the optimum high pressure for transcritical CO₂-refrigeration cycles," Int. J. The
- [5] Y. Hwang, and R. Rademacher, "Experimental investigation of the CO₂ refrigeration cycle," ASHRAE Tra
- [6] P. Neska, "CO₂ heat pump system," Int. J. Refrigeration, vol. 25, pp. 421-427, 2002.
- [7] A. Pearson, "New developments in industrial refrigeration," ASHRAE Journal, March 2001.
- [8] H. Liu, Z. Gu, and Y. Li, "Simulation of NH₃/CO₂ two-stage temperature refrigeration system," 20th Intern
- [9] L. Rolfsman, "Plant design considerations for cascade systems using CO₂," 20th International Congress c
- [10] Y. Ma, S. Zha, J. Wang, and M. Li, "The thermodynamic analysis and comparison on natural refrigerant ca
- [11] C. R. Taylor, "Carbon dioxide-based refrigerant system," ASHRAE Journal, September 2002.
- [12] 李宗興、劉正皓、陳東煒, 「自然冷媒CO₂/NH₃二元式冷凍系統熱力分析與設計參數最佳化之研究」, 國立
- [13] T. S. Lee, C. H. Liu, and T. W. Chen, "Thermodynamic analysis of optimum condensing temperature of ca
- [14] ASHRAE, 2005 ASHRAE Handbook—Fundamentals: ASHRAE, 2005.
- [15] <http://refrigerant.itri.org.tw>
- [16] 劉衛華, 制冷空調新技術及進展, 機械工業出版社, 2005。
- [17] W.F. Stoecker, Industrial Refrigeration Handbook: McGraw Hill, 1998.
- [18] N. Petter, D. Filippo, R. Havard and B. Arne "Measurements and experience on semi-hermetic co₂ compr