—

1   2

(1.   110168; 2.   300070)

:   −
            −   。   ;
                                    :

                                      。

    。   :
                17. 6 ℃   25 ℃   1

                                                                    COP
    :   −
                                                                            。
    : TB616; TB65   : A   −

DOI: 10. 16146 /j. cnki. rndlgc. 2016. 05. 005

1

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;   :
        、   1 ~ 2 。   (1)   :

  3 。

、   −   I 、Ⅱ
    3   4 ~ 11   Riv−   。
era and Cerezo
                            12   :   I
            400 × 10 −6
        5 ℃   COP   40% ;
Kiyan Parham   、   Ⅱ
            3   ;
  13 。Alonso   −   (2)   :
        14   /N、N −
                80 ℃、
    0. 3   0. 4   。

;

。

图 1

Fig. 1 Flow chart for new type jet-absorption
type heat convertors

2

2.1

:

(1)
; (2)
; (3)   、
; (4)
。

2.1.1

(1) LiBr – H_2O [15]:

$$h(w \ t) = \sum_{i=0}^{5} \sum_{j=0}^{2} A_{ij} w^i t^j \tag{1}$$

LiBr – H_2O

[15]:

$$t_{DP}(w \ t) = \frac{5}{9} \sum_{i=0}^{5} \sum_{j=0}^{2} B_{ij} w^i \left(32 + \frac{9}{5}t\right)^j - 32 \tag{2}$$

: h—   kJ/kg; t_{DP}—
℃; t—   ℃; w—
%; A_{ij} B_{ij} 15 。
: 0% < w < 70% 4.4 ℃ < t < 180 ℃ 。

(2)   [16]:

$$h_I = -1295.6097 + 560.4922 \frac{T_I}{100} - 43.$$
$$7943 \left(\frac{T_I}{100}\right)^2 + 4.4794 \left(\frac{T_I}{100}\right)^3 + 1.2685 \times 10^{-2} P_I - 2.$$
$$3458 \times 10^{-6} P_I - 3.8715 \times 10^{-3} P \left(\frac{T_I}{100}\right)^2 \tag{3}$$

: h_I—   kJ/kg; T_I—   K;
P_I—   kPa 。

(3)   [17]:

$$h_v = 1997.8546 + 0.9858 \times 10^{-2} P_v + 185.4761$$
$$\frac{T_v}{100} - 1.1942 \left(\frac{T_v}{100}\right)^2 + 0.3003 \left(\frac{T_v}{100}\right)^3 -$$
$$58.5024 P_v / \left(\frac{T_v}{100}\right)^3 - 256652.9031 P_v / \left(\frac{T_v}{100}\right)^{11} \tag{4}$$

: h_v—   kJ/kg; T_v—
K; P_v—   kPa 。

(4)   [18]:

$$\ln P_v = 9.4865 + \frac{3892.7}{42.6776 - T_v} \tag{5}$$

: T_v—   K; P_v—
MPa 。

2.1.2

(1)

$$\sum m_{in} = \sum m_{out} \tag{6}$$

$$\sum m_{in} \times w_{in} = \sum m_{out} \times w_{out} \tag{7}$$

: m_{in}—   kg/s; m_{out}—
kg/s; w_{in}—
%; w_{out}—   % 。

(2)

$$\sum m_{out} \times h_{out} = \sum m_{in} \times h_{in} + Q \tag{8}$$

: h_{out}—   kJ/kg; h_{in}—
kJ/kg; Q—   kW 。

（3）

$$Q = k \times \Delta T_{\mathrm{m}} \times F \qquad (9)$$

$$\Delta T_{\mathrm{m}} = （T_1 - T_2） - （T_3 - T_4） / \ln （T_1 - T_2） /（T_3 - T_4） \qquad (10)$$

： k— kJ/（m²·k）； F— m²； Q— kW； ΔT_{m}— K； T_1— K； T_2— K； T_3— K； T_4— K。

（4）

$$G_{\mathrm{P}} \omega_{\mathrm{P1}} + G_{\mathrm{H}} \omega_{\mathrm{H1}} - （G_{\mathrm{P}} + G_{\mathrm{H}}） \omega_3 = p_3 f_3 + \int_{f_3}^{f_1} p d f - （p_{\mathrm{P1}} f_{\mathrm{P1}} + p_{\mathrm{H1}} f_{\mathrm{H1}}） \qquad (11)$$

： ω_{p1}— m/s； ω_{H1}— m/s； ω_3— m/s； p_{p1}— N/m²； p_{H1}— N/m²； p_3— N/m²； f_{p1}— m²； f_{H1}— m²； f_3—— m²； $\int_{f_3}^{f_1} p d f$— 1—1 3—3

。

2 。
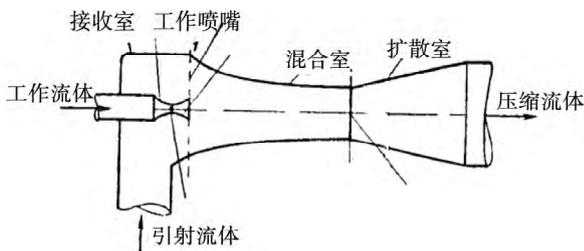
图 2
Fig. 2 Sketch of the jet injector

（5） μ ：

$$\mu = \frac{G_{\mathrm{H}}}{G_{\mathrm{P}}} \qquad (12)$$

： G_{H}— kg/s； G_{P}— kg/s。

2.2

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1stOpt

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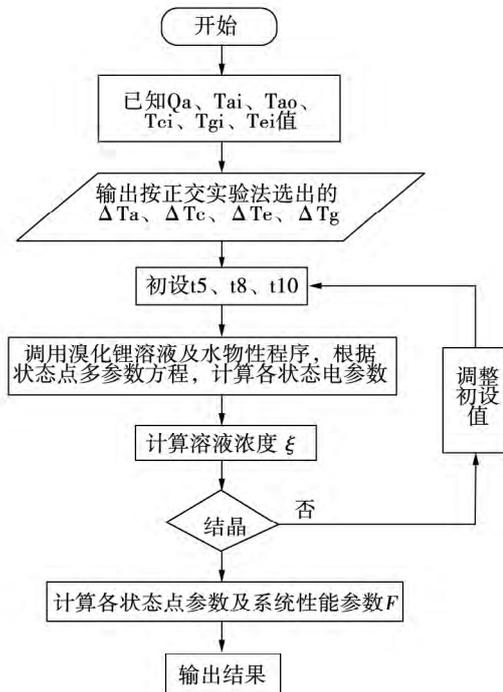
图 3
Fig. 3 Flow chart for seeking solutions to the model

3

3.1

COP 。

3.1.1

4

49.2 ℃。

。 0.862 7 kPa

11%（ 18 ℃ 16 ℃）

34.3%(0.251 66

0.337 97)。

。

。   4

0.748 6 kPa   0.862 7 kPa

。

。

0.748 6 kPa

18 ℃   16 ℃   0.213 54

0.280 12   34%。
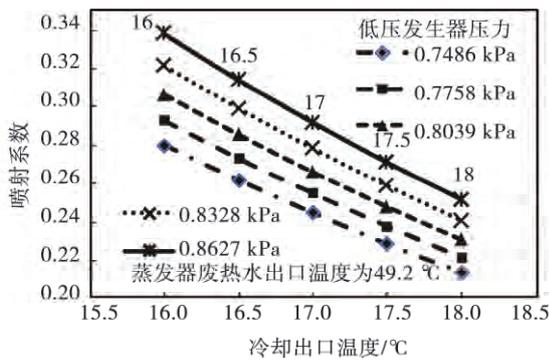

图 4

Fig. 4 Jet injection coefficient vs. the temperature
at the oulet of the cooling water at various
pressures inside the low pressure generator

3. 1. 2

5   。

16 ℃

。   49. 2 ℃

0. 748 4 kPa

0.862 7 kPa   20%   (

0. 280 12   0. 337 97)。

。

3. 1. 3

6

。   0.862 7

kPa

、

16 ℃、

51. 2 ℃   0.368 26。

图 5
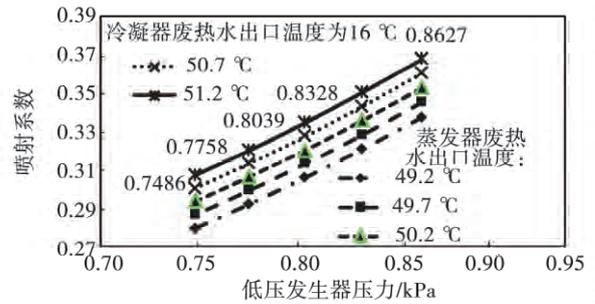
Fig. 5 Jet injection coefficient vs. the pressure inside
the low‑pressure generator at various waste heat
temperature at the outlet of the evaporator

图 6

Fig. 6 Jet injection coefficient at the outlet of the
cooling water vs. the waste heat temperature at the
outlet of the evaporator at various temperatures

4

7

66. 6 ℃   72. 6 ℃

36.56%   1. 57%;

66. 6 ℃   80 ℃   78. 27%

5.82%。   55℃

17. 6 ℃

25 ℃。

;   66. 6 ℃

30% 。   图 7

COP 66.6 ℃ 80 ℃ COP 0.243 1 0.188 1。

COP 。

图 7
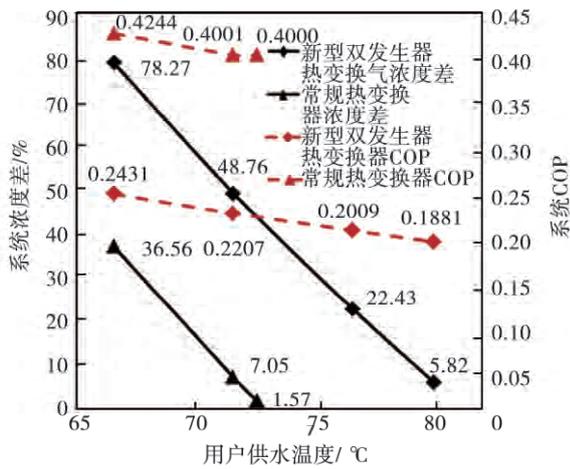
Fig. 7 Comparison with the traditional absorption type heat convertors
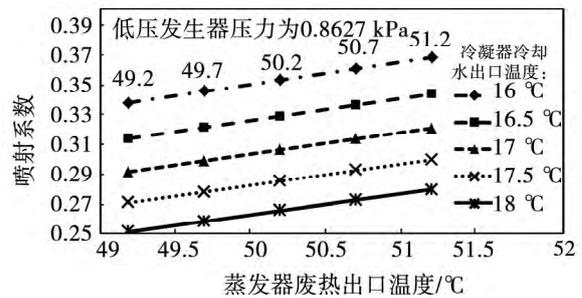
5

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30% 。

17.6 ℃ 25 ℃ COP

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performance of a stepped heat exchange ORC system. **Key words**: heat source flow division stepped heat ex-change organic Rankine cycle critical temperature nearing critical point

= Numerical Simulation Study of the Law Governing the Dis-tribution of the Falling-film Thickness Outside a Horizontal Tube   CAI Zhen ZHOU Yi-hui BI Ming-shu REN Jing-jie（College of Chemical Machinery Dalian University of Science and Technology Dalian China Post Code: 116024）//Journal of Engineering for Thermal Energy & Power. – 2016 31（5）. – 22～28

The law governing the distribution of the liquid film thickness exercises an important influence on the falling film e-vaporation process outside a horizontal tube. A CFD model for the falling film flow outside a horizontal tube was es-tablished and through simulating the liquid film thickness at various inlet speeds and different sizes of the diameter of the tube the factors influencing the liquid film thickness outside the tube in the cold state and the law governing its distribution along the circumferential angle were studied. The simulation results show that for a constant diameter of the tube the liquid film thickness will increase with an increase of the inlet speed. When the inlet speed is con-stant the liquid film thickness outside the tube will be relatively big in the zone at the top of the tube and arrive at its minimum around a place at a circumferential angle of 105 degrees. Moreover the liquid film thickness will gradu-ally decrease with an increase of the tube diameter. When the inlet speed decreases to a certain extent the "dry-up" phenomenon will appear on the tube wall. **Key words**: falling film flow outside a horizontal tube liquid film thick-ness inlet speed tube diameter circumferential angle

– = Analysis of the Performance of a Novel Jet-absorption Type Heat Convertor   WANG Zi-biao YANG Bo（College of Municipal and Environmental Engineering Sheny-ang Architectural University Shenyang China Post Code: 110168）//Journal of Engineering for Thermal Energy & Power. – 2016 31（5）. – 29～33

In the light of the low temperature rise in the traditional heat convertor systems proposed was a new type jet-absorp-tion heat convertor system with two generators. Compared with the traditional heat convertors a low pressure genera-tor and jet ejector was introduced into the system in question: the jet ejector was driven by the high-pressure refrig-erant vapor from the evaporator and the low pressure in the low pressure generator was maintained by the jet ejector thus leading to a drop of the pressure of the lithium bromide solution in the whole system and a rise of the concen-tration difference in the system. An analysis of the thermal model for the system under discussion shows that the

temperature rise of the heat pump in the system increases from the temperature rise of 17. 6 ℃ in the traditional heat convertor to 25 ℃ therefore enhancing the heat quality **Key words**: generator jet ejector absorption-type heat convertor thermodynamic analysis heat quality

= **Study of the $CaCO_3$ Foul Characteristics of an Intensified Evapo-ration Tube**   WANG Yan-kun ZHANG Hua YOU Xiao-kuan SHENG Jian (Refrigeration Technology Re-search Institute Shanghai University of Science and Technology Shanghai China Post Code: 200093) //Journal of Engineering for Thermal Energy & Power. −2016 31(5). −34 ~39

With an intensified evaporation tube serving as the object of study investigated was the law governing the fouling of $CaCl_2$-Na_2CO_3 solution on the surface of a bare tube a plane and straight obliquely-finned tube and a sawtooth-shaped obliquely-finned tube. A constant initial foul formation ion concentration method was adopted i. e. no foul-formation ion was added in the process of foul formation during the test. For several types of heat exchange tube and bare tube the foul resistant effectiveness was tested respectively at various temperatures and flow speeds. The test results show that the amount of foul formed on No. 1 plane and straight finned tube is largest far larger than that formed on the bare tube. The amount of foul formed on No. 2 straight finned tube is smallest. The fouling resistance of the sawtooth-shaped finned tube is close to that of the bare tube thus the types of their foul being also similar. **Key words**: intensified heat transfer $CaCO_3$ foul intensified evaporation tube

CO_2 = **Analysis of the Power Generation Cycle Characteristics of Supercritical Carbon Dioxide**   LIAO Ji-xiang ZHENG Qun ZHANG Hai (College of Power and Energy Engineering Harbin Engineering University Harbin China Post Code: 150000) LIU Xing-ye (College of Architectural Engi-neering Heilongjiang University of Science and Technology Harbin China Post Code: 150022) //Journal of Engi-neering for Thermal Energy & Power. −2016 31(5). −40 ~46

Five types of supercritical carbon dioxide power generation cycle were analyzed namely simple recuperative cycle recompression cycle partial cooling cycle pre-compression cycle and subsection expansion cycle. Under the same operating parameters the thermal efficiencies of the cyclic systems above mentioned were analyzed and compared. It has been found that both efficiencies of the recompression cycle and the partial cooling one are the highest approac-hing to 45%. However the highest efficiency of the partial cooling cycle can result only at a high pressure ratio while the efficiency of the cycle in question at a low pressure ratio has no obvious cutting edge when compared with