

Abstract

As a candidate idea on conceptual study of liquid metal reactor (LMR), the feasibility of using lead coolant, having chemical stability with water, for IHTS piping is investigated. Structural integrity evaluation of KALIMER-150 IHTS piping carrying lead coolant is performed by calculating the piping deflections, stresses for dead weight, and natural frequencies. The calculation results show that the use of lead coolant in the IHTS piping cannot guarantee the structural integrity of the piping to carry heavy weight lead coolant.

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2003

IHTS

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가 520°C



ANSYS

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[3].



SG Hot leg IHX

1. KALIMER

1. KALIMER

| | | Design Features of KALIMER-150 | | |
|------------------------------------|---------------------|-----------------------------------|--|--|
| | O.D | 50.8 cm | | |
| Large Piping | Thickness | 0.9525 cm 20"SCH20 | | |
| (Hot Leg/Cold Leg) | Pipe spec. | | | |
| | Radius of curvature | 76.2 cm | | |
| | Material | 316SS | | |
| | O.D | 35.56 cm | | |
| Small Piping (Hot Leg/Cold Leg) | Thickness | 0.7925 cm 14"SCH20 53.34 cm | | |
| | Pipe spec. | | | |
| | Radius of curvature | | | |
| | Material | 31688 | | |
| | O.D | 2.8 m | | |
| SG | Height | 15.6 m | | |
| No. 2 | 2 EA | | | |
| Horizontal distance of IHX-SG | | 11.5 m | | |

2 2 L 가 11.5m x 9.4m / . 8m 3m 9.4m 50.8cm , 1 [2]. 0.9525cm , 35.56cm , 0.7925cm . S.S.316 195GPa, 7840kg/m³, 0.3, 15.3 x 10⁻⁶ m/m°C 172Mpa [4]. 530°C , $0.29, \qquad 18.4 \ x \ 10^{-6} \ m/m^{o}C \quad ,$ 가 156GPa, 500°C 10,510kg/m³ 86Mpa . .

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4,5

ANSYS , 2 , 3 . PIPE16 , PIPE18 , . 66 , 47 . 1 0.85m 0.6m

38 17.7Mpa 120.5MPa

| | | | 가 | |
|---------|--------|-------|----------|--|
| S.S.316 | 172Mpa | | | |
| | | 520°C | S.S. 316 | |

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86Mpa ,

120.5Mpa

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| | | Sodium Coolant | Lead Coolant | |
|--|--|---|--------------------|--|
| Max. Deflection (x | ,y,z) | 0.2, 0.6,0.3 (mm) | 1.4, 4.1, 2.4 (mm) | |
| Max. Stress (Intens | sity, Mpa) | 17.7 | 120.5 | |
| | Mode 1 | 8.52 | 3.14 | |
| Max. Deflection (x Max. Stress (Inten Frequencies (Hz) | Mode 2 | 9.20 | 3.40 | |
| | Mode 3 | 13.1 | 4.97 | |
| Frequencies (Hz) | Mode 4 | Sodium Coolant Lead Coolant 0.2, 0.6,0.3 (mm) 1.4, 4.1, 2.4 (mm) 17.7 120.5 8.52 3.14 9.20 3.40 13.1 4.97 8.40 5.31 16.5 6.22 18.6 8.02 19.3 8.24 21.2 10.5 22.2 11.6 28.0 11.9 30.7 12.9 | 5.31 | |
| | Mode 5 | 16.5 | 6.22 | |
| | equencies (Hz) Mode 1 Mode 1 Mode 2 Mode 3 Mode 3 Mode 4 Mode 5 Mode 5 Mode 6 Mode 7 Mode 8 Mode 9 Mode 10 | 18.6 | 8.02 | |
| | Mode 7 | 19.3 | 8.24 | |
| | Mode 8 | 21.2 | 10.5 | |
| | Mode 9 | 22.2 | 11.6 | |
| | Mode 10 | 28.0 | 11.9 | |
| | Mode 11 | 30.7 | 12.9 | |

4.2

, 2 . 2 가 8.52Hz 가 3.14 Hz 1 0.5Hz 가 . 6 • 6 .

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| KALIMER-150 | 가 | 13 | | |
|-------------|---|----|---|-------|
| 120.5Mpa | | | 1 | 86Mpa |
| - | | | | |

| | 1 | 가 3.14Hz | 0.5Hz | 가 | |
|---|---|----------|-------|---|---|
| 가 | | | | | 가 |

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가 가

[1]

[2] , IHTS

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, KAERI/RR-2215/2001. MS414-WR-01-R0/01,

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2002.3.

- [3] ANSYS Computer Program Version 5.6, 1999.
- [4] ASME Code Section III, Division 1, Appendix I, 1983.



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