

Voiding Effects

Guanghao Jiao

March 12, 2024

Contents

1	Source of bubbles	1
2	Effects of bubble on heat transfer	2
2.1	Homogeneous effects	2
2.2	Local effects	2
3	Description	2
3.1	Void Coefficient	2

1 Source of bubbles

1. Preoperational filling
 - trapped gas during initial filling
 - In a normal operation, it is already removed before the operation
2. Gas entrainment
 - The formation of the vortex and bubbles at the free surface
 - reason: design of the flow path & outlet nozzle
3. Gas absorption at a free surface
 - The liquid sodium may absorb some gas
 - The amount is really small
 - only need to make sure that the sodium in contact with gas is not turbulent
4. Fission gas release

- gas in the fuel pin
 - sudden release of the high-pressured gas
 - The amount is considerable
5. Production from oil release
 - oil in the pump
 - oil contact with hot sodium \rightarrow vapor
 6. External purification and make-up circuits
 - gas in the external purification lines
 7. Entry at pipe rupture

2 Effects of bubble on heat transfer

- There are two ways that the bubbles can effect the heat transfer: small but evenly rising bubbles (homogeneous effects), and big bubbles (local effects).

2.1 Homogeneous effects

- The small bubbles rise evenly in the reactor.
- The density of the coolant was decreased.
- Even if the void fraction is up to 50%, there will be unlikely failures.

2.2 Local effects

- The big bubbles may insult some fuel pins.
- There will be unlikely failures.

3 Description

3.1 Void Coefficient