
PROBLEM 12-9N QUESTION

BWR Heat Transfer Problem

Consider a fuel assembly in a BWR. For simplicity, consider that all coolant channels are identical and all fuel rods are operating at the same uniform axial heat flux. The exit void fraction for this assembly is limited by physics considerations to 0.6.

1. What is the maximum assembly power at which the Boiling Crisis occurs? (Note that the term "Boiling Crisis" reflects that the BWR limit is on critical power, not heat flux)
2. What are the fuel rod outside wall temperature and quality as a function of z , i.e., $T_w(z)$ and $x(z)$, at an assembly power level 1/3 of the CHF power level? Ignore the subcooled boiling region because it is a highly non-equilibrium state. Make plots of your results.

DATA

Coolant mass flow rate into the assembly	= 13.86 kg/sec
Active fuel length	= 3.66 m
Assembly flow area	= $1.0 \times 10^{-2} \text{ m}^2$
Number of fuel rods	= 62
Reactor coolant pressure	= 6.89 MPa
Inlet water temperature	= 276.7°C
Density of saturated liquid	= 741.65 kg/m^3
Density of saturated vapor	= 35.93 kg/m^3
Slip ratio from Bankoff's correlation*	
Enthalpy of saturated liquid	= 1260.4 kJ/kg
Enthalpy of saturated vapor	= 2770.8 kJ/kg

**Nuclear Systems*, Vol. 1, Eq. 11-43 inserted in Eq. 11-48 with V_{vj} taken as zero.