

6.4.1 Classes of Vaporization

There are two classes of rapid vaporization of importance in the context of nuclear reactors and these are denoted here as homogeneous and heterogeneous vaporization. Homogeneous vaporization occurs when the principal source of the latent heat supply to the interface is the liquid itself. Examples are the formation and growth of a cavitation bubble in a liquid body far from a solid boundary or the vapor explosions described in section 6.4.3. On the other hand, heterogeneous vaporization occurs when the principal source of the latent heat supply to the interface is a different nearby substance or object such as a heated wall. Examples are pool boiling near a heated surface or many of the fuel-coolant interactions described in section 7.6.5. Though there is overlap between the two classes, the definitions are convenient in distinguishing the contributing features.

Moreover, each of these two classes can be subdivided into one of two circumstances. The first circumstance is that in which the growth of the vapor volume is only limited by the inertia of the surroundings, liquid or solid. In the second the vapor volume growth is more severely limited by the rate of supply of latent heat to the interface to produce the vaporization. Both of these rate-limiting growth mechanisms will be examined in the sections that follow since the rate of volume growth essentially controls the rate of damage (if any) to the structure in contact with the liquid.