DISCUSSION

The authors are grateful for obtaining data on nitrogen over such a wide range of accelerations. The writer is interested in the fact that the burnout heat flux was in proportion to acceleration to the 0.25 power. It should be noted that this result is not applicable to all surface-fluid combinations.

It is true that hydrodynamic theories of pool boiling burnout predict that burnout heat flux will be proportional to acceleration to the 0.25 power, but these theories do not admit the existence of surface effects. Two recent papers have shown that the burnout is strongly related to surface characteristics, and we might, therefore, expect the relation between burnout and acceleration to depend upon the surface nature.

Fig. 14 shows data from a motion picture study and illustrates the wetting characteristics of ethanol on platinum and on graphite. Note that the bubbles of ethanol on graphite are more spherical and thus have more fluid under them. By integrating pressure forces around the bubble it is found that the ethanol bubbles on graphite experience 50 percent more buoyancy per unit mass than ethanol on platinum. Since varying the acceleration varies the buoyancy, we might expect acceleration to affect burnout differently for the two surface-fluid combinations.

The better wetting makes buoyancy exert more influence on the ethanol-graphite combination, regardless of the exact geometry of the vapor at heat fluxes close to burnout.

Fig. 15 shows how burnout heat flux varied with acceleration produced in a centrifuge. Both curves exhibit the 0.25 proportionality up to a/g = 10, then the greater buoyant forces on the graphite surface becomes predominant and the increase is more abrupt.

The topmost curve is for water on graphite. Water wets graphite poorly, buoyancy forces on the vapor are therefore low, and the burnout heat flux increases with a/g to the 0.15 power up to a/g = 10, and then the greater buoyant forces on the graphite surface becomes predominant and the increase is more abrupt.

to $a/g = 10$. If a surface tension reducer is added, making the bubbles more spherical and thus more subject to buoyant forces, the slope is only slightly steeper up to $a/g = 10$, as the next lower curve shows. At higher $a/g$ the water with reduced surface tension shows burnout heat flux varying with $a/g$ to the 0.39 power. By reducing surface tension to 28 dyne/cm, the burnout heat flux can be made to vary with acceleration to the 0.42 power.

These and other similar data lead to the following conclusions:

1. Buoyancy forces may not be too significant up to $a/g = 10$.
2. The extent to which burnout heat flux varies with $a/g$ cannot be predicted without reference to the liquid-surface wetting characteristics.

Authors' Closure

The authors would like to thank Professor Costello for his discussion in pointing out the possible influence of surface effects on burnout heat flux. With the technique used in this study, surface effects most likely would not be manifested since the region of maximum heat flux is approached from the film boiling region, where no liquid-solid contact exists.

In connection with Fig. 15, it is interesting to note that a distinct change in slope occurs at approximately $a/g = 10$ in those cases where graphite is used as the heater surface. More experimental data with other metallic surfaces would be required to make a conclusive statement, but the authors feel that this may be a unique attribute of the graphite surface. Graphite is by nature soft and porous, and in conjunction with the violent action of boiling may demonstrate unusual nucleation characteristics.

On another point, we might remark that the bubble process mechanics seem to be significantly influenced by fluid flow patterns produced by the growing or collapsing bubble itself. This may be described by a bubble Froude number, as shown in reference [4] of the paper, in which $a/g$ is a parameter. For different fluid-surface combinations a critical value of this Froude number at which the buoyant force becomes important may be expected to be approximately a constant. It may be anticipated that this will correspond to different values of $a/g$ depending on the specific fluid-surface combination and the attendant mean size of the bubble at departure from the surface.