by Oldfield and Markworth.[3] Their explanation is based on the migration of voids by sublimation of impure matter from the hot side of a void and condensation of purified matter as a crystal facet on the cold side of a void. Gas and other impurities are released to the void in the process.

Gruber's Figs. 15 and 16 suggest that swelling and gas release in oxide fuels are inversely related. This is contrary to principles proposed on the basis of experimental observations by Hilbert et al.[4] Their experiments show that swelling and gas release are sequentially coupled in oxide fuels at high temperatures. Swelling, and the accompanying bubble formation, is a necessary predecessor of bubble interlinkage, bubble migration, and gas release. See also, Iwano and Oi.[5]

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REPLY TO "COMMENTS ON 'A GENERALIZED PARAMETRIC MODEL FOR TRANSIENT GAS RELEASE AND SWELLING IN OXIDE FUELS' "

I regret that my paper[1] apparently did not sufficiently identify the problems treated. I find no fault with the comments made by Chubb,[2] except that the points made in his letter do not apply to the paper in question.

The paper discusses transient fission gas release from unrestructured (or perhaps equiaxed) fuel grains to the grain boundaries. Release from the fuel pellet to its surroundings, or release to the central void, are not considered explicitly, nor is steady-state release.

Our approach has been that, at the onset of a rapid thermal transient typical of hypothetical conditions for a liquid-metal fast breeder reactor, most of the fission gas inventory will be associated with the cooler, unrestructured fuel. It is the release of this gas from the fuel, or fuel swelling caused by this gas, that can influence the course of a reactor accident by inducing reactivity feedbacks through fuel disruption or displacements.

Since transient gas release from unrestructured fuel does not depend on sweeping by lenticular voids, and since the columnar fuel is assumed to contain a negligible amount of fission gas at the onset of the transient, collapse of lenticular voids under pressure has no bearing on the problem treated in the paper.

Again, the point made in the paper concerning the inverse relationship between gas release and swelling refers to intragranular gas behavior: If gas is released from the grain, it cannot contribute to intragranular swelling. It can, however, contribute significantly to intergranular swelling, which is often the major component of fuel swelling. Intergranular swelling and release of gas from the fuel pellet through interlinked porosity are indeed sequentially coupled. In fact, a prior step in the sequence is the release of gas from the grain to the grain boundary. This step is the one assumed to be rate controlling and treated in the paper. The generalized parametric model can then be applied to define the source term for subsequent analysis of intergranular gas behavior, in much the same manner as an earlier and much less sophisticated model was applied by Hofmann and Meek.[3]

I appreciate this opportunity to clarify the realm of applicability and the purpose of my calculations.

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