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REPLY TO "COMMENTS ON 'SOLVENT PERFORMANCE IN THTR NUCLEAR FUEL REPROCESSING. PART II: ON THE FORMATION OF DIBUTYL PHOSPHORIC ACID BY RADIOLYTIC AND HYDROLYTIC DEGRADATION OF THE TBP-*n*-PARAFFIN EXTRACTANT' "

It was clearly stated in the referred paper,[1] and the authors were well aware of the fact, that the parameters influencing the HDBP yield in TBP degradation are numerous. The authors very consciously limited their investigations to the application of a few parameters only, in order to get some basic but significant information on TBP behavior, recognizing the fact that actual process conditions were not fully simulated and again stating that not all questions are answered.

Saunders[2] is not correct in saying that the authors have considered only two of four degradation contributing reactions:

1. Hydrolysis of TBP in the aqueous phase was investigated by immediate extraction of HDBP into the organic phase during contact with nitric acid. The results are plotted in Fig. 4 of Ref. 1.

2. Radiolysis in the aqueous phase is implicitly included in the radiolysis experiments with a nitric-acid-equilibrated, which also means water-saturated, solvent. The result of this experiment was the reduction of the overall HDBP yield below the corresponding value from nitric acid/water-free solvent beyond a certain dose rate at a given nitric acid concentration in the organic phase. This is documented in Tables III and IV and in Fig. 6 of Ref. 1.

Moreover, Sonntag et al.[3] have not worked on TBP, but on trimethyl-phosphate in alkaline solutions, finding increasing G(acid) values with increasing pH. Their results may or may not be applicable to the Thorex extractant system, but they are certainly no proof for Saunders' criticism.

The presence of metal ions will indeed influence the behavior of the organic solvent. This, however, was not the purpose of this publication, but it may be the subject of a future work.

B.-G. Brodda

Kernforschungsanlage Jülich GmbH
Institute für Chemische Technologie
D-517 Jülich, Postfach 1913
Federal Republic of Germany

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

It is interesting that some of the predictions by Gruber[1] are diametrically opposite to the observed behavior of oxide fuels. Gruber's Fig. 15 predicts that gas release from oxide fuels will increase as increasing hydrostatic pressure or stress is applied.

It has been observed experimentally that when a stress is applied to cause the collapse of one of two samples containing lenticular voids, the voids remain in the unstressed sample and disappear in the stressed sample. These results have not been published, but the same phenomenon on a macroscopic scale is to be seen in Fig. 16 of Bain's report.[2] Bain's figure shows several drill holes, one of which has been reduced in diameter by thermal expansion stresses in the plastic central region of the oxide.

Since it is generally agreed that the migration of bubbles in the columnar grain region of oxide fuels is necessary for producing large amounts of gas release, it follows that if a stress is applied to reduce the size of or to eliminate these bubbles, then gas release will be diminished. This is not the result predicted by Gruber.

A possible explanation for this failure of Gruber's model may be found in the assumption that the bubbles in the columnar grain region are moving by a surface diffusion mechanism. It should be obvious that a bubble whose cross section looks like a plano-convex "lenticular" void is not responding to surface tension forces as a first-order determinant of its shape.

A physical explanation for the development of the "lenticular" shape of bubbles in oxide fuels was published