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DISCUSSION

A. F. Conn[1]—This question actually pertains to discussions which we have had with the authors, and only indirectly to the ideas contained in the paper. Specifically, the authors have advised us that the shape of the rate of erosion versus time curves which they obtained in their magnetostrictive erosion tests differs from those curves obtained in such tests at HYDRONAUTICS, Incorporated. In particular the TNO rate versus time curves show a long, flat region at the maximum rate as opposed to the rather peaked curves at the maximum erosion rate which are obtained in results reported from tests in the discusser's laboratory. I wonder if perhaps these differences are actually related to the very large differences in maximum mean depths which are obtained at TNO versus those at HYDRONAUTICS and in other standard erosion tests because of the relatively small intensities of cavitation used by TNO. The TNO tests have peak depths which are on the order of 60 to 200 μm, whereas many of the tests at HYDRONAUTICS and elsewhere have peak depths on the order of 1/8 in. (3200 μm) or more. Perhaps basically different mechanisms are operating at these two extremal values of cavitation intensity, and hence the differences in the rate curves are not due to testing procedures or material variables?

J. W. Tichler (authors' closure)—The authors appreciate Dr. Conn's critical remark on their work in general. Before giving my opinion upon this point, it seems to me that it is good to erase some possible misunderstanding upon the meaning of "peak depth" in Dr. Conn's discussion. Obviously, the meaning of "peak depth" is not the mean depth of erosion at the point where the erosion rate reaches its maximum, because this maximum in general occurs at mean depths of erosion on the order of 10 to 100 μm. Thus, with peak depth the maximum mean depth of erosion (that is, at the end of the erosion test) is meant. This maximum mean depth of erosion obviously depends on erosion intensity *and* test duration.

In my opinion, the sloping down of the erosion rate (that is, the existence

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of a maximum or peak rate) is connected with changes in the surface condition of the eroding material. This has also been concluded from work in the discusser's laboratory. In Ref 7 of the paper, the deceleration of the erosion process is attributed to the appearance of craters in the eroding surface, and the hypothesis is put forward that the deceleration is due to the protective action of gas bubbles, trapped in craters with appropriate size and shape. This idea has been worked out quantitatively in Ref *13* of the paper. From these considerations, it follows that the authors do *not* have the opinion that for each material a flat peak should be found, which is illustrated by Fig. 5 of Ref 7. A sharp peak will be found for materials with a high tendency toward crater formation, in which craters are formed in an early stage of the erosive process. Conversely, a flat peak will be found for materials with a high resistance against pit formation (r_p), in which the larger, bubble-trapping craters are formed only after longer times of exposure to the erosion process, especially when the materials have also a larger resistance against uniform material removal (R_e). Some such materials have been presented in Table 7 of the paper. It is obvious that one tends to find flat peaks when developing materials for practical applications in which these properties are especially favorable.

It is the authors' opinion that sharp peaks can also be found, if no measures are taken such as to obtain a homogeneous attack of the eroding specimen surfaces. If the attack is inhomogeneously divided along the surface of the specimen, craters appear already in the heaviest attacked parts of the specimen surface when other parts of the attacked surface are still in the incubation period, as was illustrated in Fig. 1 of Ref 7 of the paper.

When performing tests for extremely prolonged test times, one should well keep in mind the trivial effect that the peak *seems* to be sharper due to the necessary compression of the time scale in the erosion rate versus time diagram. Another effect is that, when measuring at higher erosion intensities, one tends to perform the erosion tests with larger steps, which introduces larger inaccuracies in deriving the erosion rate versus time curve from the mean depth of erosion versus time curve. This can result also in the observation of a sharper peak. However, all these differences are gradual, not essential. The authors did not find any essential difference in erosion mechanisms when operating at varying intensities of erosion.