Discussion

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In this paper the authors infer that the laboratory test they have developed simulates the wear that occurs in main bearings of XHP 3 rock bits. While they do present some results of their laboratory tests, they do not compare these results with those from field tests so that the degree of correlation is established. Recently, important aspects of simulating wear that occurs by abrasion in various service enviroments have been thoroughly reviewed by Moore.[2] Much of his review may be applied to other types of wear, as well. One important way of assessing extent to which a laboratory test duplicates the wear occurring in a particular service environment is to determine if the same wear mechanisms are present. This can be done by comparing the worn surfaces and the wear debris that are produced. Although the authors do include some photographs of the wear debris and worn surfaces produced by their laboratory test, they do not present photographs of the surfaces of worn main bearings or of the spindles that were in contact with these bearings. Furthermore, there is no discussion of the type of wear debris that are generated during the operation of the rock bits. Were the worn surfaces of used main bearings and spindles examined and the wear debris also? If such an examination has not been carried out, then I would recommend that it should be done so that the degree to which the laboratory test simulates main bearing wear is determined.

In Figs. 9–11, in which photographs of wear debris and worn surfaces are displayed, the figure captions indicate that these were obtained from tests in which the load was 43.08 MPa which is greater than the critical load shown in Table 1. Have the authors also collected photographs of wear debris and worn surfaces of test specimens run at loads below the critical load? If so, what differences did they observe? If they have not collected such photographs, I believe that this should be done because the wear mechanisms occurring above the critical load will probably be different from those occurring below.

In examining Table 1, I was surprised to see that the values for $P_{cr}n$ were precisely the same for both the Ag85Mn15 material and the copper alloy. It has been my experience that in wear testing some variability occurs from test to test even when the same material is used. Therefore at the same rotational speed I would expect that the vlaue of P_{cr} for Ag85Mn15 to be different from the value obtained for the copper alloy. Can the authors explain why they obtained exactly the same values for both materials? Furthermore, in Conclusion 2 the authors state that the $P_{cr}n$ value for the main bearings of 8.5 in. XHP3 rock bits is 1786.6 N/m-s. The units that are given are not the same as those in Table 1. How was the value for $P_{cr}n$ for the rock bits obtained, and how does it compare with the value given in Table 1 when the same units are used for both?

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[2]Moore, M. A., "Laboratory Simulation Testing for Service in Abrasive Wear Environments," *Proceedings of the Sixth International Conference on Wear of Materials*, ASME, April 5–9, 1987, Houston, Texas.

Authors' Closure

The authors would like to thank Dr. P. A. Swanson for his comments and contribution in his discussion.

In this paper we only present some results of our laboratory tests, and subsequently we will examine the worn surfaces and the wear debris of used main bearings and spindles after field tests.

Since the friction pairs run at loads below the critical load are in normal wear condition, the photographs of worn surfaces and wear debris of test specimens do not shown here. In any condition, there are neither abrasive wear particles, nor fatigue wear particles, indicating that the wear mechanism occurring above the critical load will probably be same as those occurring below.

During test one sample would take a long time, and there were many samples under examination, so we used the large load steps. We also believe this will cause the differences between Ag85Mn15 samples and copper alloy samples to be missed.