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For proper "wearing-in" of many metal parts, it is necessary to have good resistance to accelerated mechanical abrasion. Chemically pitted surfaces are known to be superior to "super-finished" surfaces in many such applications for wearing-in characteristics.

In most industrial applications the mechanical effect is complementary to the lubrication-film effect of separating the surfaces but somewhat decreases the importance accorded to the lubrication effect alone. There is ample evidence that empirical methods have determined in many cases the importance of microscale engineered roughness, which is predicted (qualitatively, at this time) from the mechanical analysis of accelerated mechanical association. In future surface engineering such interpretations undoubtedly will get tested for quantitative validity.

Discussion

J. W. Pennington.[3] The author's interesting analysis of the mechanical aspect of seizing in metal wear is an additional contribution to our concept of one of the phases of the very complicated and intricate phenomenon which we call wear. To get an understanding of this problem, we certainly must follow the author's example and analyze what is happening at the actual points of contact.

In the comparison of this analysis with empirical data, the author points out that a very smooth surface finish leads more readily to seizing than a rougher finish. The writer believes that this should be restricted to borderline or dry-lubrication conditions. Smooth surfaces make more easily possible the formation of a fluid film which will separate the moving surfaces completely. However, if the film is ruptured and contact does occur, galling or seizing will occur more readily with smooth surfaces than with rough surfaces. The nature of the surface finish, whether roughness is due to hills or valleys, is also important.

The analogy of a cutting tool with a built-up edge seems to be a good one and makes it easier to visualize the mechanism by which the accelerated damage from seizing occurs.

The discussion of self-lubricating alloys is interesting and it is well to compare this with T. L. Oberle's analysis of the effect of hardness and modulus on wear.[4] The giving-way or yielding of asperities in a porous material, whether or not the pores are filled with a lubricant, seems to tie in directly with Oberle's analysis. Certainly, the ready yielding of the asperities in an open material indicates a low effective modulus of elasticity.

Although the diagrams which the author presents are relatively simple, a very concentrated study is necessary to reveal the thinking that is behind such an analysis.

[3] Chief Engineer, Metal Products Division, Piston Ring Department, Koppers Company, Baltimore, Md. Mem. ASME.

[4] "Hardness, Elastic Modulus and Wear of Metals," by T. L. Oberle, SAE Transactions, July, 1952, pp. 511–515.

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