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**ADHESIVE WEAR AND PARTICLE EMISSION:
TRANSITIONS BETWEEN LEAST WEAR, MILD WEAR AND SEVERE WEAR**

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Based on contact mechanics of rough surfaces, Archard [1], in 1953, formulated a law of adhesive wear stating that the amount of worn material is proportional to the normal force, the sliding distance and is inversely proportional to the hardness of the material. Five years later, in 1958, Rabinowicz suggested a criterion determining the size of wear particles [2]. Both concepts of Archard and Rabinowicz were very attractive due to their simplicity and robustness. However, they lacked the details of the mechanism of the postulated processes. Almost 50 years later, in 2016, Aghababaei, Warner and Molinari (AWM) used quasi-molecular simulations to confirm the Rabinowicz criterion [3].

In this presentation, we discuss a broad spectrum of problems in wear from the unifying point of view of the Archard-Rabinowicz-AWM concept of adhesive wear. We complete this concept with only one, but essentially important “detail”: an “asperity-free” formulation of the Rabinowicz criterion [2]. With this link, all parts of the Archard and Rabinowicz concept can be implemented into a closed numerical model using the FFT-based Boundary Element Method. We show that this combination of old concepts with modern contact mechanics allows for a contact mechanics-based understanding of the wear process.

We discuss two types of wear: one leading to the formation of a limiting topography which does not wear further (“running-in” type of wear) and the usual continuously proceeding wear. In the latter case, numerical simulations show that the regimes of least wear, mild wear and severe wear predicted by Rabinowicz do indeed exist and have a clear microscopic interpretation. The worn volume in the region of mild wear is typically to a power law of the normal force with an exponent not necessarily equal to one. Thus, Archard’s law is not necessarily valid. But this is nothing new and has been observed experimentally already many decades ago [4].

We also discuss the development of the topography of the worn surface, as well as the distribution of the sizes of wear particles. Emission of wear particles into the environment becomes an increasingly important technical and health issue and is of large current interest.

We analyse a number of examples of wear depending on material properties, interface interaction and external load and try to formulate a “guide” for navigating the overwhelming literature on wear.

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