

Physical Properties, Triboemission and Wear of Hydrogenated Carbon Films

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Triboemission is the emission of electrons, ions and photons during the wear of solids [1-7]. Metals emit electrons due to chemical interactions between the fresh surface formed by wear and the surrounding active molecules such as oxygen [7]. On the other hand, semi-conductors and insulators emit not only electrons but also negative and positive ions and even photons during the wear of solids [1-6]. A micro-plasma state is formed at the wearing contact region due to gas phase and liquid phase discharge by intense electric fields generated at the wearing region [2-6]. These triboemission particles attack hydrocarbon molecules and cause tribochemical reactions forming high molecular weight products on the sliding surfaces which reduce friction and wear [7].

Coatings of amorphous and hydrogenated amorphous carbon films are used to protect the magnetic recording layer of the hard disk of a computer from wear. To reduce wear of the carbon layer, chemically stable perfluoropolyether (PFPE) oils are also coated on the carbon film as approximately a mono-molecular layer. However, the PFPE oil molecules decompose at the sliding interface of the head sliding on the disk and generate gases. PFPE decomposition is serious, since it leads to wear of the carbon layer, which in turn causes wear of the important magnetic recording layer. Recently triboemission phenomena is being noted as one of the cause of the PFPE decomposition.

This paper describes the characteristics and mechanism of triboemission during the wear of solids. The triboemission characteristics, friction and wear of amorphous and hydrogenated amorphous carbon films are then described in relation to the physical properties of carbon films, i.e., the structures, surface energy, internal stress, and hydrogen content.

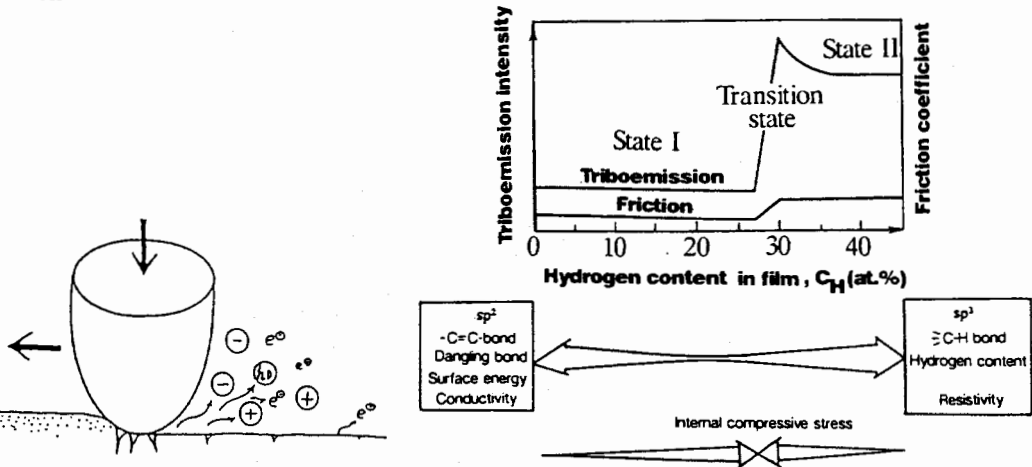


Fig. 1 Triboemission phenomena (left) and dependence of triboemission intensity and friction coefficient on hydrogen content, C_H in carbon film (right).

Ref.

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