IBM Technical Disclosure Bulletin Vol. 23 No. 12 May 1981

ORGANIC MATERIALS FOR ABLATIVE RECORDING

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A new class of ablative recording materials for storage applications is described, and the class comprises semiconducting and conducting polymer films.

The storage device can be made in two different embodiments. In the first embodiment the storage device comprises a layered structure on a suitable substrate, such as glass, with a thin, opaque, highly reflecting metal film deposited on the substrate, and a thin film of the polymer material deposited on the metal film. The second embodiment comprises a thick film of the polymer material deposited on the substrate.

Writing is effected through the use of an incident laser beam of proper wavelength and sufficient energy to cause physical destruction and/or chemical modification of the polymer material. The change is accompanied by a significant alteration of the reflectivity of the material, which can be read out optically. Conducting or semiconducting polymers are particuarly suited for ablative recording technology since they possess band gaps lying on the low energy side of the visible and near-infrared optical spectrum. Thus, they have the very high optical densities necessary for the efficient absorption of energy contained in the emission spectrum of common practical lasers (Ar, He-Ne, GaAs).

In addition, being organic substances, the decomposition temperatures of conducting and semiconducting polymers generally lie lower than the melting points of conventional metals and semiconductors, yet their specific heats and thermal conductivities are similar in magnitude to the latter. Therefore, the polymer compounds require lower expenditure of laser energy than current ablative recording materials.

Furthermore, techniques of organic synthesis add a new dimension to the fabrication of ablative recording media. Vacuum technology is not required, and the high energy expenditure needed by evaporative procedures can be circumvented. In mass production, economies of scale usually experienced with organic processes can be expected.

The preferred embodiment of the storage system utilizes films of conducting or semiconducting polyacetylene, $(CH)_x$, as the active recording medium. Polyacetylene is a well-known semiconducting polymer which can be made highly conducting upon treatment with appropriate oxidizing agents. It can be considered as the prototype of the currently expanding number of semiconducting/conducting polymers.

For the thin film configuration described above, an approximately 1000 Å thick film of undoped trans-$(CH)_x$ was deposited on a 2000 Å opaque Al film on a glass substrate. The match between the optical constants of the semitransparent $(CH)_x$ film and Al were such as to give a dark blue reflectivity. Upon impingement with focused 5800 Å pulsed dye laser radiation, the $(CH)_x$ film was abated away, revealing the highly reflecting Al film contrasted against the dark blue background mentioned above. For the thick film structure, a thick film of trans-$(CH)_x$ ($\sim$1-5 μ) was deposited directly on the glass substrate. At these thicknesses, the $(CH)_x$ film is opaque and highly reflecting, giving the overall appearance of a common metal like aluminum. With the same laser beam conditions as before, a black spot readily distinguishable against the highly reflecting undestroyed $(CH)_x$ film was produced.