

SMPTE Study Group on New Magnetic Media

Report on Activities and Status, October 1986

By mid-1985, a maturing technology that had just brought new videotape magnetic coatings to the consumer field was beginning to receive serious consideration from professional users. Specifically, metal particle (MP) tape, which had pervaded the consumer 8mm VCR market, was now being proposed for adoption in the new M-II professional format. Although broadcasters had been previously introduced to MP tape during earlier deliberations on 1/4-in. VTR format standardization, such was the doubt and controversy among the participants of that group regarding the suitability of MP coatings in tortuous ENG environments, that it was eventually dismissed from consideration. However, as one of the final acts of the 1/4-in. Working Group, a recommendation was made for continued study of MP tape in professional applications. It was from that recommendation, coupled with a desire to investigate the properties of other new tape coating materials, that the SMPTE Committee on Video Recording and Reproduction Technology (VRRT) established a Study Group on New Magnetic Media, the findings of which are reported here.

Members for the Study Group were solicited from all relevant segments of the broadcast and tape industries, including consultants, television network and group owners, and manufacturers of magnetic particles, tape, cassettes, and broadcast equipment. A list of sponsoring organizations is given in Appendix 1.

The high degree of interest in the Study Group's work was evident at the first meeting, held in December 1985, when 34 engineers from 20 sponsoring organizations participated in planning the future activities of the Group. Initial effort was directed toward development of a charter which affirmed the charge from VRRT to limit consideration by the Study Group to television tape recording. Additionally, the charter called for the following procedures:

1. Presentation of tutorial material, results of experiments, related practical information, and proposed applications of new magnetic media to television tape recorders.

2. Determination of the impact of media characteristics upon VTR design.

3. Critical analysis on the above material by qualified participants.

4. Presentation of laboratory test results to clarify unresolved issues.

5. Determination of future activity by results of the above procedures.

Having determined the basic procedures for investigating new magnetic media, attention turned to implementing them. Presentation of tutorials was determined to be the best vehicle for disseminating the diverse specialized information that resided with the various members of the Study Group. However, some very sensitive issues were involved here. Time constraints would not permit customary lengthy corporate approval cycles; participants were being asked, in the interest of a factual understanding of all issues, to reveal the negative aspects of products as well as the positive ones — a matter of utmost commercial concern. In some cases tutorials would not be completed papers, but would consist of a few illustrations accompanied by informal remarks. And finally, in the ensuing committee discussions, many frank statements were anticipated which, if taken out of context, could suffer serious misinterpretation. Taking these factors into consideration, the Study Group reluctantly decided that content of the tutorials and details of proceedings would be treated as confidential committee matters, and that reports would be limited to a discussion of conclusions. With the adoption of this policy, favorable conditions existed for presentation and discussion of tutorials in an atmosphere of openness and candor.

[Edit. Note: Requests for further information on the following should be directed to the authors.]

A Summary of Tutorials Presented to the Study Group on New Magnetic Media

"Study Group on New Magnetic Media: Why?" by Robert Paulson, AVP Communication. Discussed the place of study programs in view of growing acceptance of MP tape, and advocated early effort on setting standards for new formats.

"Magnetic Recording Tapes for Video Recording," by T. Kitamoto, M. Nakamura, and S. Takayama, Fuji Photo Film Co., Ltd. Discussed physical and magnetic characteristics of several recording media. Presented results of performance measurements.

"Comments on Metal Tape for Videorecording Applications," by S. Miya, Kanto Denka Kogyo Co., Ltd. Briefly covered historical background and applications of metal tape. Treated performance in still-frame, drop-outs and environmental effects.

"Overview of Recent Developments in Magnetic Particles for Professional Videorecording," by Brian Gustard, Pfizer Pigments, Inc. Addressed sources of supply, handling requirements, operational concerns, and design factors for several media and related recording formats.

"Magnetic Particle Properties and Recording Performance," by S. A. Bendson, 3M Co. Used a comprehensive chart of properties and curves of relative performance in a survey of appropriate applications for various media.

"Stability of Metal-Powder Against Corrosion," by J. Gerum, Agfa-Gevaert AG. Treated methods of stabilizing metal particles and the effects of specific area on tape performance. Presented data on magnetic stability of 8mm tape.

"Characteristics and Performance of Metal Particle Tape in a Broadcast Video Recorder," by Masao Kawagishi and Takashi Niwa, Matsushita Electric Industrial Co., Ltd. Described recent improvements in MP

tape for the M-II format, especially relating to surface smoothness, response, head wear, and dropouts.

"Characteristics and Applications of Metal Tape," by R. Chubachi, S. Takahashi and K. Kobayashi, Sony Corp. Described manufacturing process and discussed many physical magnetic and operational properties of MP tape, largely from experience with 8mm.

"The Mechanical Interface of Tape with the Hardware," by Henry Zahn, Robert Bosch GmbH. Treated the importance of mechanical parameters with emphasis on surface roughness and air-film lubrication relative to SNR and "stiction."

"NBC Experiences in the Use of Metal Particle Tape," by Eric Pohl, National Broadcasting Co. Described early experience with MP tape in prototype M-II studio VTRs. Covered dropout performance, stability, and resistance to mechanical shock.

"Experience with 8-Millimeter M.P. Tape," by Fred Scott, Hitachi Denshi America. Described mechanical design of an 8mm broadcast transport. Presented head performance data; related experiences in adverse environmental conditions.

"Morphology and Magnetic Properties of the Iron Oxide Layer Formed on Iron Accicular Particles," by M. Kishimoto, S. Kitahato, and A. Asemiya, Hitachi Maxell, Ltd. Detailed description of oxide stabilization process of pure iron particles, illustrated with electron micrographs of particle structure.

"Comments on Metal Tape Chemical Stability," by S. Takahashi, R. Chubachi, and K. Kobayashi, Sony Corp. Presented data on MP tape reactivity after storage under four different controlled-environment conditions. Discussed tape surface properties.

"Long Term Storage of Metal Particle Tape," by Masao Kawagishi and Phil Livingston, Matsushita Electric Industrial Co. Defined three principal storage conditions and then related

change in actual video performance of MP recordings stored in each condition.

"Bibliography: Metal Particle and Metal Evaporated Video Tapes," by Forrest J. Watson, Eastman Kodak Co. and The Center for Magnetic Recording Research of University of California at San Diego. A listing of 44 technical papers on topics related to metal evaporated and metal particle tape giving author, source, language, and synopsis.

Conclusions

At the beginning of presentation of the tutorials there were only two materials put forth as possible contenders for new applications in magnetic tape recording for television: barium ferrite and metal particles. But as the presentations continued, and particularly as associated discussions evolved, it became evident that, although broadcast VTR applications for barium ferrite might eventually materialize for digital recording, neither the material itself, nor broadcast VTR design, is currently in a stage of development that could result in a meaningful benefit from its use before 1990.

In contrast to the situation with barium ferrite, the overwhelming result of both the tutorials and the stimulating discussion that accompanied each one was that metal particle tape was gradually being acquitted of the adverse reputation originally associated with it. More and more evidence was being received that MP tape will quite likely fulfill the rigorous requirements of broadcasters. Such was the intensive search for possible deficiencies in MP tape that we soon realized many of the questions being asked of its characteristics had never even been asked of oxide tape!

This is not to say there are no unknowns about MP media, but the principal ones, such as stability in hostile storage conditions, head wear, and product availability seem to be under control, if not fully resolved.

There remain issues related to safety, cost, forward and reverse slow motion, editing, and further study of audio and video performance, particularly with tape and VTR interchange over long time intervals. This investigative work will be carried on by some tape and equipment manufacturers in their normal process of product development, but it is questionable whether it will be completed in a time frame that would justify regular meetings of the Study Group. Therefore, the Chairman has been directed by the members to review circumstances at the end of 1986 and then determine if sufficient new information is available to justify another meeting. In the meantime, the Study Group will remain dormant, but continue to solicit new information, which will be disseminated to the members as it is received.

—Robert G. Thomas, Chairman

Appendix 1: Sponsoring Organizations

Agfa-Gevaert AG
Ampex Corp.
AVP Communication
BASF-AG
Robert Bosch GmbH
Canadian Broadcasting Corp.
Capital Cities/ABC
CBS Television
Dupont Magnetic Products Division
Eastman Kodak Co.
Fuji Photo Film Co., Ltd.
Luigi Gallo, Consultant
Group W
Hercules, Inc.
Hitachi Denshi, Ltd.
Hitachi Maxell, Ltd.
Kanto Denka Kogyo Co.
National Broadcasting Co.
Pfizer Pigments, Inc.
Matsushita Electrical Industrial Co., Ltd.
Measurement Analysis Corp.
Shape Video
Sony Corp.
TDK Corp.
3M Magnetic Media Division
Tokyo Broadcasting System