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Dynamic Viscoelastic Measurements of Magnetic Film III

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1. Introduction

There might be difficult in making specimen from the material for the viscoelastic measurement. For example, it is the case of viscoelastic property evaluation of the magnetic coating layer of the magnetic tapes such as cassette tapes and video tapes.

The evaluation method of this case uses the Composite Material Data Calculation Software. The case shown in Figure 1, from the measurement result of only base material and the whole material (base film and coating layer), the viscoelastic data of the coating layer is calculated¹⁾.

In this brief, the viscoelastic data of the magnetic coating layer is calculated by the Composite Material Data Calculation Software.

2. Measurement results

Magnetic tapes such as cassette tape and video tape has the double-layered structure (Figure 1) which is coated with the magnetic materials onto the polymer base film.

Figure 2 shows the measurement result of the whole of video tape²⁾. Figure 3 shows the measurement result of the PET base film used in this video tape. These measurement results are the simultaneous measurement result of the temperature dispersion and frequency dispersion results and E' , E'' , and $\tan\delta$ curves of for 5 frequencies from 0.5 to 10Hz. Sample thickness is $16\mu\text{m}$ for the base material PET film and $18\mu\text{m}$ for whole video tape thickness including base film.

Figure 4 shows the result of the comparison of each measurement data at 1Hz shown in Figure 2 and 3. The α -dispersion (glass transition) and β -dispersion (local mode relaxation) is observed at the PET base film data shown in Figure 3 and 4. Videotape data shown in Figure 2 and 4, α - and β -dispersion of PET and the dispersion peak is observed in the vicinity of 55 to 60°C caused by the glass transition of the magnetic layer binder material.

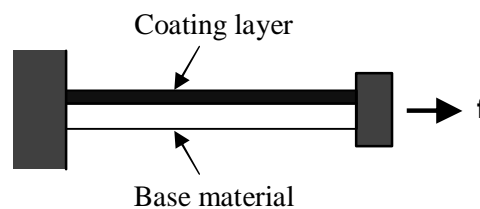


Figure 1 Double-layered structure (Tension mode)

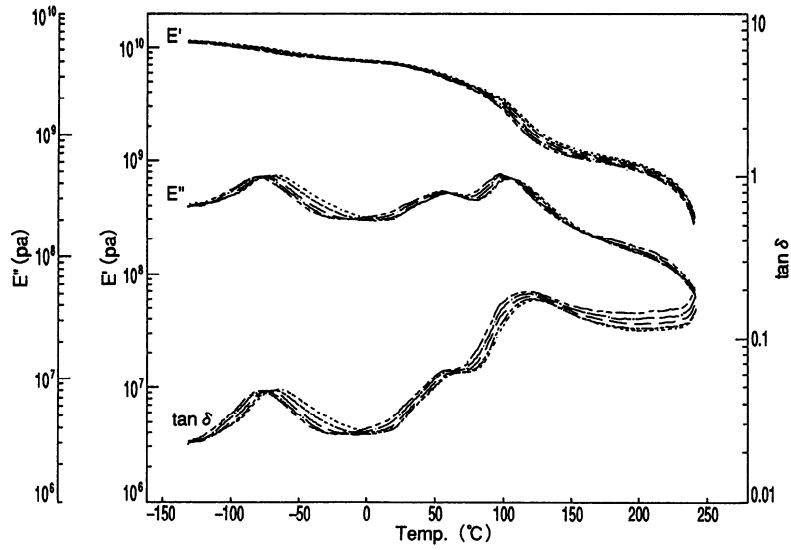


Figure 2 Dynamic viscoelasticity spectrum of video tape

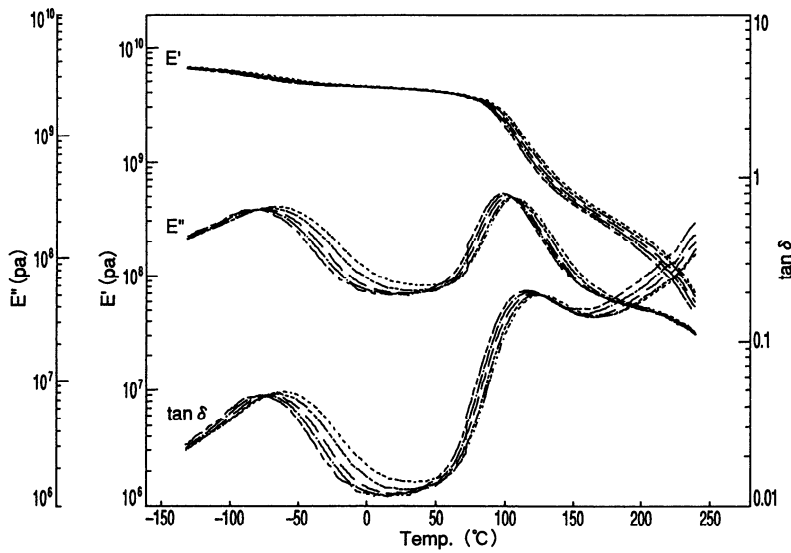


Figure 3 Dynamic viscoelasticity spectrum of PET base film

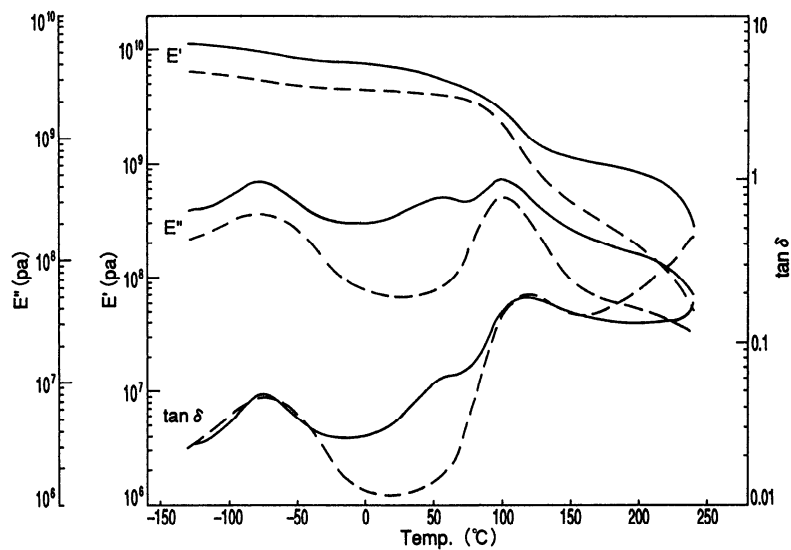


Figure 4 Comparison of E' , E'' and $\tan \delta$ curves for video tape and PET base film (1Hz)

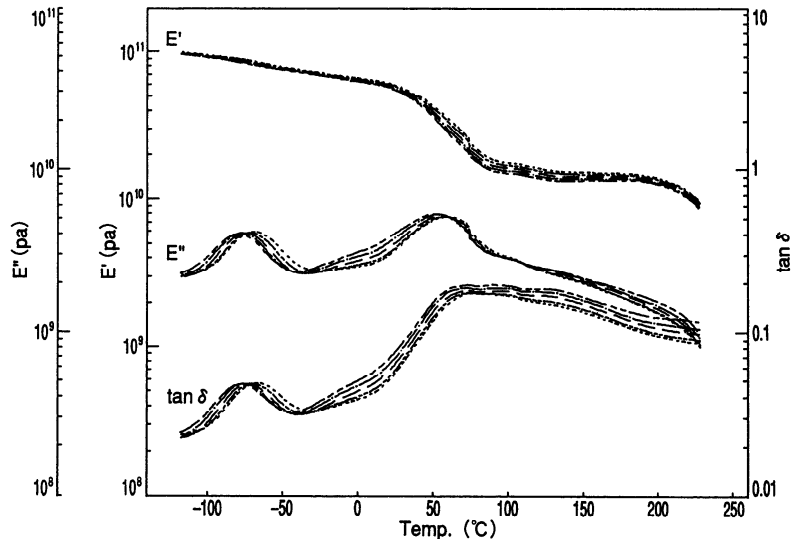


Figure 5 Viscoelastic data of video tape magnetic layer
(Calculated by the Composite Material Data Calculation Software)

Figure 5 shows the calculated result of the viscoelastic data of the video tape magnetic layer using the Composite Material Data Calculation Software with the data shown in Figure 2 and 3. The analysis result in Figure 5 shows the storage modulus change of the magnetic layer and the dispersion peak caused by the binder material.

3. Conclusion

In this brief, viscoelasticity data of the coating layer of video tape is measured by the dynamic viscoelastic measurement. By using the Composite Material Data Calculation Software, the viscoelastic property can be evaluated. This method can be used for the coating materials such as painted films and packing materials as well as magnetic films.

References

- 1) Nobuaki Okubo and Nobutaka Nakamura, *Netsu Sokutei*, **32**, No.4, 204-205 (2005)
- 2) Nobuaki Okubo, Application Brief DMS No.20, Hitachi High-Tech Science Corporation (1992)