



FINAL REPORT ON
OFFICE OF NAVAL RESEARCH CONTRACT NO. N00014-84-K-0508

October 14, 1990

Dr. Kenneth J. Wynne
Office of Naval Research
Director, Chemistry Division (Acting)
Code 413
800 North Quincy Street
Arlington, Va. 22217

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Dear Dr. Wynne:

This research program resulted in two Ph. D. theses, by M.C. O. Chang, 1988, and J. J. Fay, 1990. The major results were as follows:

1. A group contribution theory was developed to describe the area under the loss modulus-temperature peak, LA, in the glass transition region of homopolymers and single-glass transition statistical copolymers and related compositions. Within wide limits, each chemical group on the polymer was found to contribute a definite proportion of the area. Groups directly associated with the backbone chain contribute the most to damping, while long side chains actually are detrimental.

2. Deviations from this theory for multiphase morphologies were studied for IPN's and related compositions. It was discovered that some morphologies resulted in a significant increase in LA, thus increasing the efficiency for damping sound and vibrations. For high tan delta values, the continuous phase should be very soft, with a large amount of dispersed phase near the glass transition temperature. The basis for providing a systematic approach to superdamping materials was laid.

Technical Reports: Reference is made to reports filed 10/24/88, 11/27/89, and 10/14/90.

Publications:

The following papers were published, or are in press:

1. "Effect of Morphology, Crosslink Density and Miscibility on IPN Damping Effectiveness," to Polym. Eng. Sci.
2. "Evaluation of the Area under Linear Loss Modulus-Temperature Curves," to J. Appl. Polym. Sci.
3. Papers in R. D. Corsaro and L. H. Sperling, Eds., "Sound and Vibration Damping with Polymers," ACS Books, 1990:
 - a. Sound and Vibration Damping with Polymers: Basic

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Wynne, P. 2.

Viscoelastic Definitions and Concepts

- b. Interpenetrating Polymer Networks, An Overview
 - c. Cross-Poly(vinyl methyl ether)-inter-cross-Polystyrene
Interpenetrating Polymer Networks: Loss Modulus and Damping Behavior
4. "Group Contribution Analysis of the Damping Behavior of Homopolymers, Statistical Copolymers, and Interpenetrating Polymer Networks Based On Acrylic, Vinyl, and Styrenic Mers," J. Polym. Sci., B, Polym. Phys., 26, 1627 (1988).
5. "Characterization of the Area Under Loss Modulus and Tan Delta-Temperature Curves: Acrylic Polymers and Their Sequential Interpenetrating Polymer Networks, J. Appl. Polym. Sci., 34, 409 (1987).

In addition, various portions of the work were reviewed in papers to be published in Macromolecular Chemie, Damping '89, Damping '91, the short course, "Sound and Vibration Damping with Polymers," (at Lehigh University, June, 1990), etc.

Best personal regards.

Yours truly,

L. H. Sperling
L. H. Sperling

cc: Dr. D. A. Thomas
Ms. M. J. Hill
Ms. C. Sottosanti

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Dist. "A" per telecon Dr. Kenneth Wynne.
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