## RUBBERLIKE ELASTICITY A MOLECULAR PRIMER

## JAMES E. MARK

Department of Chemistry University of Cincinnati Cincinnati, Ohio

## **BURAK ERMAN**

School of Engineering Bogazici University Istanbul, Turkey



A WILEY-INTERSCIENCE PUBLICATION

**JOHN WILEY & SONS** 

New York • Chichester • Brisbane • Toronto • Singapore

## CONTENTS

PART A. Fundamentals		1
1.	Introduction	3
2.	Some Rubberlike Materials	17
3.	Preparation and Structure of Networks	21
4.	Elementary Statistical Theory for Idealized Networks	29
5.	Statistical Theory for Real Networks	35
6.	Elastic Equations of State	41
7.	Swelling of Networks	49
8.	Force as a Function of Deformation	53
9.	Force as a Function of Temperature	59
10.	Force as a Function of Structure	71

PART B. Additional Topics	83
11. Networks Prepared under Unusual Conditions	85
12. Strain-Induced Crystallization and Ultimate Properties	89
13. Bimodal Networks and Non-Gaussian Behavior	101
14. Birefringence	111
15. Segmental Orientation	117
16. Rotational Isomerization	123
17. Osmotic Compressibility, Critical Phenomena, and Gel Collapse	127
18. Neutron Scattering from Networks	133
19. Bioelastomers	137
20. Filled Elastomers	145
21. Current Problems and New Directions	155
APPENDIXES	159
A. Relationships between $\nu$ , $\xi$ , and $M_c$	161
B. Relationships between $\langle \tilde{r}^2 \rangle$ , $\langle (\Delta r)^2 \rangle$ , $\langle r^2 \rangle_0$ , and $\phi$	165
C. Equations of State for Miscellaneous Deformations from the Constrained Junction Theory	167
D. Fortran Program for Calculating [ $f^*$ ]	169
E. Illustrative Calculations of $M_c$	171
REFERENCES	175
BIBLIOGRAPHY	183
AUTHOR INDEX	187
SUBJECT INDEX	191