MARY C. BOYCE

DEAN OF ENGINEERING
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Mary C. Boyce is Dean of Engineering at The Fu Foundation School of Engineering and Applied Science at Columbia University in the City of New York and the Morris A. and Alma Schapiro Professor of Engineering. Prior to joining Columbia, Dean Boyce served on the faculty of the Massachusetts Institute of Technology (MIT) for over 25 years, leading the Mechanical Engineering Department from 2008 to 2013.

Her research focuses on materials and mechanics, particularly in the areas on multi-scale and nonlinear mechanics of polymers and soft composites, both those that are man-made and those formed naturally. Her leadership in the field of mechanics of materials has expanded understanding of the interplay between micro-geometry and the inherent physical behavior of a material, which has led to innovative hybrid material designs with novel properties. Her research has been documented in over 170 archival journal articles spanning materials, mechanics, and physics. She has mentored over 40 M.S. thesis students and over 25 Ph.D. students. She has been widely recognized for her scholarly contributions to the field, including election as a fellow of the American Society of Mechanical Engineers, the American Academy of Arts and Sciences, and the National Academy of Engineering.

Dean Boyce leads the education and research mission of Columbia Engineering with more than 175 faculty, 1500 undergraduate students, 2500 graduate students, and 100 postdoctoral fellows. She is committed to facilitating and celebrating the creativity and innovation of students and faculty. She has launched a Columbia MakerSpace, created Ignition Grants to support student physical and digital ventures, sponsored *Columbia Design Challenge: Confronting the Ebola Crisis*, and established the SEAS Senior Design Expo. She also has inaugurated SEAS participation in the Columbia Startup Lab, and expanded entrepreneurship programming and the Columbia Venture Competition in close partnership with the University's Columbia Entrepreneurship Initiative. Dean Boyce is a strong advocate for enabling interdisciplinary research collaborations across the School and the University, including extensively transforming research spaces and expanding our faculty body in cross-cutting fields as wide ranging as Data Science, Nano Science, Sensing and Imaging, Sustainability, and Engineering in Medicine.

Dean Boyce is also a dedicated engineering educator and has been honored for her teaching at MIT, where she was named a MacVicar Faculty Fellow and received the Joseph Henry Keenan Innovation in Undergraduate Education Award. She earned her BS degree in engineering science and mechanics from Virginia Tech, and her MS and PhD degrees in mechanical engineering from MIT.

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***Education*:**

Ph.D.	Massachusetts Institute of Technology	1987
S.M.	Massachusetts Institute of Technology	1983
B.S.	Virginia Polytechnic Institute and State University	1981

***Selected Academic Appointments and Service*:**

Joined Columbia University as Dean of Engineering	2013- Present
Selected MIT Appointments:	
Joined the MIT Faculty	1987
Ford Professor of Engineering	2011-2013
Gail E. Kendall (1978) Professor of Mechanical Engineering	2000-2011
Institute Committee on the Undergraduate Program	1993-1994
Institute/School of Engineering Committee on Women Faculty Equity	1999-2001
Head, Mechanics Division, Mechanical Engineering	2001-2005
Institute Task Force on Medical Insurance	2004-2006
School of Engineering Strategic Planning Committee	2007, 2011
Head, Department of Mechanical Engineering	2008-2013
MIT Engineering Council	2008-2013
School of Engineering Undergraduate Education	2008-2009
MIT International Advisory Council	2011-2013
MIT Innovation and Entrepreneurship Ecosystem, Chair	2012-2013

***Selected Honors and Awards*:**

NSF Presidential Young Investigator Award	1991
DuPont Young Faculty Award	1992-1995
Joseph Henry Keenan Innovation in Undergraduate Education Award	1998
ASME Special Achievement Award for Young Investigator in Applied Mechanics	1998
Fellow, American Academy of Mechanics	1999
MacVicar Faculty Fellow	2000
Fellow, American Society of Mechanical Engineers	2004
Fellow, American Academy of Arts and Sciences	2004
Member, National Academy of Engineering	2012

Selected External Professional Service

ASME Applied Mechanics Division Executive Committee	1999-2004
U.S. National Congress on Theoretical and Applied Mechanics	2000,2001
External Board, Mechanical Engineering: Purdue University	2004
NAE/NRC Committee on Integrated Computational Materials Engineering	2006-2008
External Board, Mechanical Engineering, University of Southern California	2008
External Board, Mechanical Engineering, University of Michigan	2008
External Board, School of Engineering, Ecole Polytechnic Federal Lausanne	2009
External Board, Mechanical Engineering, Stanford University	2010
National Academies Board on Army Science and Technology	2012
External Board, Mechanical and Aerospace Engineering, Princeton University	2012

Selected Publications of Mary C. Boyce

Professor Boyce, together with her research group and collaborators, has published over 150 peer-reviewed archival journal publications; over 60 conference proceedings papers, and is a co-inventor on four issued and several pending U.S. Patents. Professor Boyce has mentored 40 S.M. and 25 Ph.D. theses as well as several postdoctoral associates. A list of Archival Refereed Journal Articles is provided below:

1. Boyce, M.E., Argon, A.S., Parks, D.M., "Mechanical Properties of Compliant Particles Effective in Toughening Glassy Polymers", *Polymer*, 28, 1680-1694, September 1987.
2. Boyce, M.C., Parks, D.M., Argon, A.S., "Large Inelastic Deformation of Glassy Polymers, Part I: Rate-Dependent Constitutive Model", *Mechanics of Materials*, 7 15-33, 1988.
3. Boyce, M.C., Parks, D.M., Argon, A.S., "Large Inelastic Deformation of Glassy Polymers, Part II: Numerical Simulation of Hydrostatic Extrusion", *Mechanics of Materials*, 7 35-47,1988.
4. Boyce, M.C., Weber, G.G., Parks, D.M., "On the Kinematics of Finite Strain Plasticity", *Journal of the Mechanics and Physics of Solids*, 37, 647-665, 1989.
5. Boyce, M.C., Parks, D.M., Argon, A.S., "Plastic Flow in Oriented Glassy Polymers", *International Journal of Plasticity*, 5, 593-615, 1989.
6. Boyce, M.C., Arruda, E.M., "An Experimental and Analytical Investigation of the Large Strain Compressive and Tensile Response of Glassy Polymers", *Journal of Polymer Engineering and Science*, 30, 1288-1298, 1990.
7. Boyce, M.C., Palmer, M.L., Seo, M.H., Schwartz, P., Backer, S., "A Model of the Tensile Failure Process in Woven Fabrics", *Journal of Applied Polymer Science*, Applied Polymer Symposium 47 - Fiber Society 50th Anniversary Technical Conference, 383-402, 1991.
8. Realff, M.L., Seo, M.H., Boyce, M.C., Backer, S., "On the Mechanical Properties of Fabric Woven from Yarns Produced on Different Spinning Technologies - Yarn Failure as a Function of Gauge Length", *Textile Research Journal*, 61, 517-530, 1991.
9. Karafillis, A.P., Boyce, M.C., "Tooling Design Accommodating Springback Error", *J. Mat. Process. Tech.*, 32, 144, 1991.
10. Sim, A.B., Boyce, M.C., "Finite Element Analyses of Real-Time Stability Control in Sheet Forming Processes", *Trans. ASME Journal of Engineering Materials and Technology*, 114, 180-188, 1992.
11. Boyce, M.C., Montagut, E., Argon, A.S., "The Effects of Thermomechanical Coupling on the Cold Drawing Process of Glassy Polymers", *Journal of Polymer Engineering and Science*, 32, 1073-1085, 1992.
12. Karafillis, A.P., Boyce, M.C., "Tooling Design in Sheet Metal Forming Using Springback Calculations", *International Journal of Mechanical Sciences*, 34, 113-131, 1992.
13. Arruda, E.M., Boyce, M.C., "A Three-Dimensional Constitutive Model for the Large Stretch Behavior of Rubber Elastic Materials", *Journal of the Mechanics and Physics of Solids*, 41, 389-412, 1993.
14. Hasan, O.A., Boyce, M.C., Li, X.S., Berko, S., "An Investigation of the Yield and Post-Yield Behavior and Corresponding Structure of PMMA", *Journal of Polymer Science, Part B: Polymer Physics Edition*, 31, 185-197, 1993.
15. Li, X.S., Boyce, M.C., "On the Measurement of Structural Relaxation in Glassy Polymers Using Positron Annihilation Lifetime Spectroscopy", *Journal of Polymer Science, Polymer Physics Edition*, 31, 869-873, 1993.
16. Arruda, E.M., Boyce, M.C., "Evolution of Plastic Anisotropy in Amorphous Polymers during Finite Straining", *International Journal of Plasticity*, 9, 697-720, 1993.

17. Seo, M.H., Realff, M.L., Pan, N., Boyce, M.C., Schwartz, P., Backer, S., "Mechanical Properties of Fabric Woven from Yarns Produced by Different Spinning Technologies: Yarn Failure in Woven Fabric", *Textile Research Journal*, 63, 123-134, 1993.
18. Arruda, E.M., Boyce, M.C., Quintus-Bosz, H., "Effects of Initial Anisotropy on the Finite Strain Deformation Behavior of Glassy Polymers", *International Journal of Plasticity*, 9, 783-811, 1993.
19. Hasan, O.A., Boyce, M.C., "Energy Storage during Inelastic Deformation of Glassy Polymers", *Polymer*, 34, 5085-5092, 1993.
20. Jayachandran, R., Boyce, M.C., Argon, A.S., "Mechanics of the Indentation Test and Its Use to Assess Adhesion of Polymeric Coatings", *Journal of Adhesion Science and Technology*, 7, 813-836, 1993.
21. Karafillis, A., Boyce, M.C., "A General Anisotropic Yield Criteria Using Bounds and a Transformation Weighting Tensor", *Journal of Mechanics and Physics of Solids*, 41, 1859-1886, 1993.
22. Boyce, M.C., Arruda, E.M., Jayachandran, R., "The Large Strain Compression, Tension, and Simple Shear of Polycarbonate", *Polymer Engineering and Science*, 34, 716-725, 1994.
23. Scelzo, W.A., Backer, S., Boyce, M.C., "Mechanistic Role of Yarn and Fabric Structure in Determining Tear Resistance of Woven Cloth - Part I: Understanding Tongue Tear", 64, 291-304, *Textile Research Journal*, 1994.
24. Scelzo, W.A., Backer, S., Boyce, M.C., "Mechanistic Role of Yarn and Fabric Structure in Determining Tear Resistance of Woven Cloth - Part II: Modelling Tongue Tear", 64, 321-329, *Textile Research Journal*, 1994.
25. Arruda, E.M., Boyce, M.C., Jayachandran, R., "Effects of Strain Rate, Temperature, and Thermo-Mechanical Coupling on the Large Strain Deformation of Glassy Polymers", *Mechanics of Materials*, 19, 193-212, 1995.
26. Jayachandran, R., Boyce, M.C., Argon, A.S., "Thermomechanical Analysis of Indentation Behavior of Thin PMMA Coatings", *Journal of Computer Aided Materials Design*, September, 1994.
27. Hasan, O.A., Boyce, M.C., "A Constitutive Model for the Nonlinear Viscoelastic Viscoplastic Behavior of Glassy Polymers", *Polymer Engineering and Science*, 35, 331-344, 1995.
28. Jayachandran, R., Boyce, M.C., Argon, A.S., "Design of Multi-Layer Polymeric Coatings for Indentation Resistance", *Journal of Computer Aided Materials Design*, 2, 151-166, 1995.
29. Taylor, L., Cao, J., Karafillis, A.P., Boyce, M.C., "Numerical Simulation of Sheet Metal Forming", *J. Mater. Process. Tech.*, 29, 1995.
30. Karafillis, A.P., Boyce, M.C., "Tooling and Binder Design for Sheet Metal Forming Processes Compensating Springback Error", *Journal of Machine Tools and Manufacture*, 36, 503-526, 1995.
31. Sunseri, M., Cao, J., Karafillis, A.P., Boyce, M.C., "Accomodation of Springback in Channel Forming Using Active Binder Control", *Tran. ASME Journal of Engineering Materials and Technology*, 118, 426-435, 1996.
32. Cao, J., Boyce, M.C., "Wrinkling Behavior of Rectangular Plates under Lateral Constraint", *International Journal of Solids and Structures*, 34, 153-176, 1997.
33. Zaroulis, J., Boyce, M.C., "Temperature, Strain Rate, and Strain State Dependence of Evolution in Mechanical Behavior and Structure of PET with Finite Strain", *Polymer*, 38, 1303-1315, 1997.
34. Boyce, M.C., "Direct Comparison of the Gent and the Arruda-Boyce Constitutive Models of Rubber Elasticity", *Rubber Chemistry and Technology*, 69, 781-785, 1997.

35. Cao, J., Boyce M.C., "A Predictive Tool for Delaying Wrinkling and Tearing Failure in Sheet Metal Forming", *Trans. ASME Journal of Engineering Materials and Technology*, 119, 354-365, 1997.
36. Realff, M.L., Boyce, M.C., Backer, S., "A Micromechanical Model of the Tensile Behavior of Woven Fabric", *Textile Research Journal*, 67, 445-459, 1997.
37. Bergstrom, J.S., Boyce, M.C., "Constitutive Modelling of the Large Strain Time-Dependent Behavior of Elastomers", *Journal of the Mechanics and Physics of Solids*, 46, 931-954, 1998.
38. Chui, C., Boyce, M.C., "A Control Volume Technique for Computing Continuum Deformation Measures in Discrete Polymeric Systems", *Journal of Non-Crystalline Solids*, 235, 612-618, 1998.
39. Ayala, H.M., Hart, D.P., Yeh, O.C., Boyce, M.C., "Wear of Elastomeric Seals in Abrasive Slurries", *Wear*, 220, 9-21, 1998
40. Llana, P.G., Boyce, M.C., "Finite Strain Behavior of Poly(ethylene terephthalate) above the Glass Transition Temperature", *Polymer*, 40, 6729-6751, 1999.
41. Chui, C., Boyce, M.C., "Monte Carlo Modelling of Amorphous Polymer Deformation: Evolution of Stress with Strain", *Macromolecules*, 32 (11), 3795-3808, 1999.
42. Bergstrom, J.S., Boyce, M.C., "Mechanical Behavior of Particle Filled Elastomers", *Rubber Chemistry and Technology*, 72, 633-656, 1999.
43. Realff, M.L., Pan, N., Seo, M., Boyce, M.C., Backer, S., "Stochastic Simulation of the Failure Process and Ultimate Strength of Blended Continuous Yarns", *Textile Research Journal*, 70 (5), 415-430, 2000.
44. Socrate, S., Boyce, M.C., "Micromechanics of Toughened Polycarbonate", *Journal of the Mechanics and Physics of Solids*, 48, 233-273, 2000.
45. Boyce, M.C., Socrate, S., Llana, P.G., "Constitutive Model for the Finite Deformation Stress-Strain Behavior of PET above the Glass Transition", *Polymer*, 41, 2183-2201, 2000.
46. Tzika, P., Boyce, M.C., Parks, D.M., "Micromechanics of Deformation in Particle-Toughened Polyamides", *Journal of the Mechanics and Physics of Solids*, 48, 1893-1929, 2000.
47. Boyce, M.C., Arruda, E.M., "Constitutive Models of Rubber Elasticity: A Review", *Rubber Chemistry and Technology*, 73, 504-523, 2000.
48. Cao, J., Yao, H., Karafillis, A., Boyce, M.C., "Prediction of Localized Thinning in Sheet Metal Using a General Anisotropic Yield Criterion", *International Journal of Plasticity*, 16, 1105-1129, 2000.
49. Bergstrom, J.S., Boyce, M.C., "Large Strain Time-Dependent Behavior of Filled Elastomers", *Mechanics of Materials*, 32, 627-644, 2000.
50. Boyce, M.C., Kear, K., Socrate, S., Shaw, K., "Deformation of Thermoplastic Vulcanizates", *Journal of the Mechanics and Physics of Solids*, 49, 1073-1098, 2001
51. Boyce, M.C., Socrate, S., Yeh, O.C., Kear, K., Shaw, K., "Micromechanisms of Deformation and Recovery in Thermoplastic Vulcanizates", *Journal of the Mechanics and Physics of Solids*, 49, 1323-1342, 2001.
52. Boyce, M.C., Yeh, O.C., Socrate, S., Kear, K., Shaw, K., "Micromechanisms of Cyclic Softening in Thermoplastic Vulcanizates", *Journal of the Mechanics and Physics of Solids*, 49, 1343-1360, 2001.
53. Bergstrom, J.S., Boyce, M.C., "Deformation of Elastomeric Networks: Relation between Molecular Level Deformation and Classical Statistical Mechanical Models of Rubber Elasticity", *Macromolecules*, 34(3), 614-626, 2001.
54. Socrate, S., Boyce, M.C., Lazzeri, A., "A Micromechanical Model for Multiple Crazing in High Impact Polystyrene", *Mechanics of Materials*, 33, 155-175, 2001.
55. Socrate, S., Boyce, M.C., "A Finite Element Based Die Design Algorithm for Sheet Metal forming on Reconfigurable Tools", *Trans.ASME Journal of Materials Engineering and Technology*, 123 (4), 489-495, 2001.

56. Boyce, M.C., Arruda, E.M., "Swelling and Mechanical Stretching of Elastomeric Materials", *Mathematics and Mechanics of Solids*, 6, 641-659, 2001.
57. Bergstrom, J.S., Boyce, M.C., "Constitutive Modeling of the Time-Dependent and Cyclic Loading of Elastomers and Application to Soft Tissues", *Mechanics of Materials*, 33, 523-530, 2001.
58. Xia, Q.S., Boyce, M.C., Parks, D.M., "A Constitutive Model for the Anisotropic Elastic-Plastic Deformation of Paper and Paperboard", *International Journal of Solids and Structures*, 39, 4053-4071, 2002.
59. Danielsson, M., Parks, D.M., Boyce, M.C., "Three-Dimensional Micromechanical Modeling of Particle-Toughened Polymeric Materials", *Journal of the Mechanics and Physics of Solids*, 50, 351-379, 2002.
60. van Dommelen, J.A.W., Parks, D.M., Boyce, M.C., Brekelmans, W.A.M., Baaijens, F.P.T., "Micromechanical Modeling of the Thermo-Elasto-Viscoploastic Behavior of Semi-Crystalline Polymers", *Journal of the Mechanics and Physics of Solids*, 51, 519-541, 2003.
61. Qi, H., Joyce, K., Boyce, M.C., "Durometer Hardness and the Stress-Strain Behavior of Elastomeric Materials", *Rubber Chemistry and Technology*, 76, 419-435, 2003.
62. Capaldi, F.M., Boyce, M.C., Rutledge, G.C., "Enhanced Mobility Accompanies the Active Deformation of a Glassy Amorphous Polymer", *Physical Review Letters*, 89 (17), 175505-(1-4), 2002.
63. Danielsson, M., Parks, D.M., Boyce, M.C., "Constitutive Modelling of Porous Hyperelastic Materials", 36(4), 347-358, *Mechanics of Materials*, 2004.
64. van Dommelen, J.A.W., Parks, D.M., Boyce, M.C., Brekelmans, W.A.M., Baaijens, F.P.T., "Micromechanical Modeling of Intraspherulitic Deformation of Semicrystalline Polymers", *Polymer*, 44, 6089-6101, 2003.
65. Qi, H.J., Teo, K.B.K., Lau, K.K.S., Boyce, M.C., Milne, W.I., Roberston, J., Gleason, K.K., "Determination of Mechanical Properties of Carbon Nanotubes and Vertically Aligned Carbon Nanotube Forests using Nanoindentation", *Journal of the Mechanics and Physics of Solids*, 51(11-12), 2213-2237, 2003.
66. Capaldi. F.M., Boyce, M.C., Boyce, Rutledge, G.C., "Molecular Response of a Glassy Polymer to Active Deformation", *Polymer*, 45(4), 1391-1399, 2003.
67. Sheng, N., Boyce, M.C., Parks, D.M., Rutledge, G.C., Abes, J.J., Cohen, R.E., "Multiscale Micromechanical Modeling of Polymer/Clay Nanocomposites and the Effective Clay Particle", *Polymer,* 45(2), 487-506, 2004.
68. Pantano, A., Boyce, M.C., Parks, D.M., "Nonlinear Structural Mechanics Based Modeling of Carbon Nanotube Deformation", *Physical Review Letters*, 91(14), Art. No. 145504, 2003.
69. Pantano, A., Boyce, M.C., Parks, D.M., "Mechanics of Deformation of Single- and Multi-Wall Carbon Nanotubes", *Journal of the Mechanics and Physics of Solids*, 52, 789-821, 2004.
70. Parsons, E., Boyce, M.C., Parks, D.M., "An Experimental Investigation of the Large Strain Tensile Behavior of Neat and Rubber-Modified Polycarbonate", *Polymer*, 45, 2665-2684, 2004.
71. Pantano, A., Parks, D.M., Boyce, M.C., "Mechanics of Axial Compression of Single and Multi-wall Carbon Nanotubes", *Trans. ASME Jnl. Engineering Materials and Technology*, 126 (3), 279-284, 2004.
72. Qi, H.J., Boyce, M.C., "Constitutive Model for Stretch-Induced Softening of the Stress-Stretch Behavior of Elastomeric Materials", *Journal of the Mechanics and Physics of Solids*, 52, 2187-2205, 2004.
73. Pantano, A., Nardelli, M., Parks, D.M., Boyce, M.C., "Mixed Finite Element-Tight Binding Electromechanical Analysis of Carbon Nanotubes", *Journal Applied Physics* , 96 (11), 6756-6760, 2004.

74. Qi, H.J., Boyce, M.C., "Stress-Strain Behavior of Thermoplastic Polyurethane", *Mechanics of Materials*, 31, 817-839, 2005.
75. Parsons, E., Boyce, M.C., Parks, D.M., Weinberg, M., "3D Large Strain Tensile Behavior of Neat and Calcium Carbonate Filled HDPE", *Polymer*, 46, 2257-2265, 2005.
76. Dupaix, R.B., Boyce, M.C., "Finite Strain Behavior of PET and PETG", *Polymer*, 46, 4827-4838, 2005.
77. Mulliken, A., Boyce, M.C., "Mechanics of the Rate-Dependent Elastic-Plastic Deformation of Glassy Polymers from Low to High Strain Rates", *International Journal of Solids and Structures*, 43, 1331-1356, 2006.
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80. Capaldi, F.M., Rutledge, G.C., Boyce, M.C., " Structure and Dynamics of Blends of Polyhedral Oligomeric Silsesquioxanes and Polyethylene by Atomistic Simulation", *Macromolecules*, 38, 6700-6709, 2005.
81. Arslan, M., Boyce, M.C., "Constitutive Modeling of the Finite Deformation Behavior of Membranes Possessing a Triangulated Network Microstructure", *Journal of Applied Mechanics*, 73, 536-543, 2006.
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83. Yi, J., Boyce, M.C., Balizer, E., Lee, G., "Large Deformation Rate-Dependent Stress-Strain Behavior of Polyurea and Polyurethane", *Polymer*, 47, 319-329, 2006.
84. Bamberg, E., Grippo, C.P., Wanakamol, P., Slocum, A.H., Boyce, M.C., Thomas, E.L., "A Tensile Test Device for In-Situ Atomic Force Microscope Mechanical Testing", *Precision Engineering*, 30 (1), 71-84, 2006
85. Danielsson, M., Parks, D.M., Boyce, M.C., "Micromechanics, Macromechanics and Constitutive Modeling of the Elasto-Viscoplastic Deformation of Rubber-Toughened Glassy Polymers", *Journal of the Mechanics and Physics of Solids*, 55, 533-561, 2007.
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87. Mulliken, A.D., Boyce, M.C., "Polycarbonate and a Polycarbonate-POSS Nanocomposite at High Rates of Deformation", *Trans. ASME, Jnl. Engineering Materials and Technology*, 128, 543, 2006.
88. Capaldi, F.M., Boyce, M.C., Rutledge, G.C., "The Mechanical Properties of Crystalline Cyclopentyl Polyhedron Oligomeric Silsesquioxane", *Jnl. Chemical Physics*, 124, 214709, 2006.
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93. Sarva, S., Mulliken, A.D., Boyce, M.C., "The Mechanics of Large Strain Inhomogeneous Deformation of Polymeric Materials under Dynamic Loading Conditions", *Journal de Physique IV France*, 134, 95-101, 2006.
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95. Cantournet, S., Boyce, M.C., Tsou, A.H., "Micromechanics and Macromechanics of Carbon Nanotube Enhanced Elastomers", *Journal of the Mechanics and Physics of Solids*, 55, 1321-1339, 2007.
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100. Bertoldi, K., Boyce, M.C., "Mechanics of the hysteretic large strain behavior of mussel byssus threads", *Journal of Materials Science*, 42, 8943-8956, 2007.
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