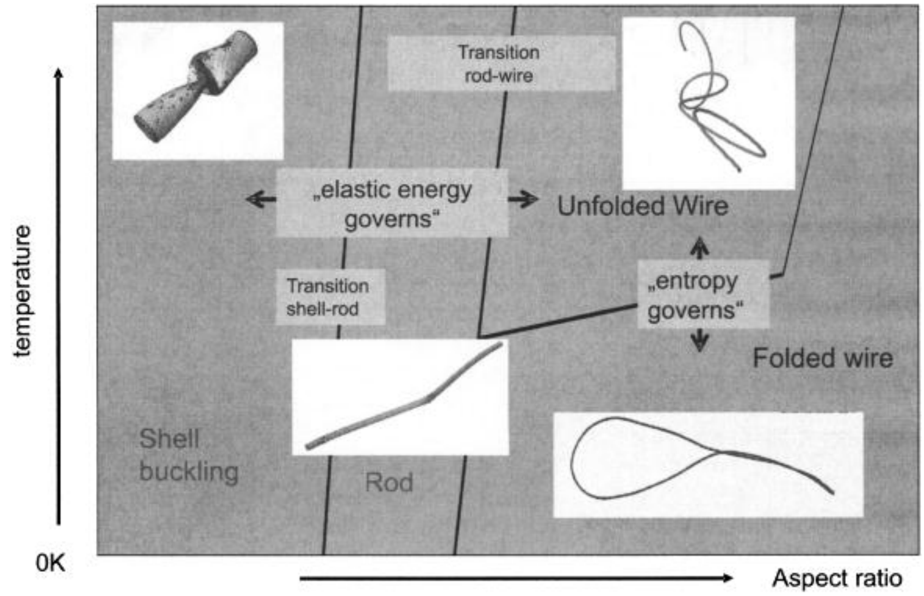
Professor Markus J. Buehler



From: Markus J. Buehler, Yong Kong, Huajian Gao and Yonggang Huang, "Self-folding and unfolding of carbon nanotubes", ASME Journal of Engineering Materials and Technology, Vol. 126, No. 1, December 2005

See:
https://en.wikipedia.org/wiki/Markus_J._Buehler
http://web.mit.edu/mbuehler/www/group/Markus_Buehler-biosketch.pdf
https://www.azom.com/experts.aspx?iExpertID=238

McAfee Professor of Engineering
Director, Laboratory for Atomistic and Molecular Mechanics (LAMM)
Head, Department of Civil and Environmental Engineering
Massachusetts Institute of Technology

Education and Career (from Wikipedia):
Before joining MIT in 2005, he served as the Director of Multiscale Modeling and Software Integration at Caltech's Materials and Process Simulation Center in the Division of Chemistry and Chemical Engineering. He received a Ph.D. in Chemistry from the University of Stuttgart and the Max Planck Institute for Metals Research after obtaining a M.S. in Engineering Mechanics from Michigan Tech, and undergraduate studies in Chemical and Process Engineering at the University of Stuttgart.

Research (from Wikipedia):
Buehler has a background in materials science, engineering science and applied mechanics. Buehler's research focuses on bottom-up simulation of structural and mechanical properties of biological, bioinspired and synthetic materials across multiple scales, with a specific focus on materials failure from a nanoscale and molecular perspective, and on developing a fundamental understanding of how functional material properties are created in natural, biological and synthetic materials. He is best known for the use of simple computational models to explain complex materials phenomena in biology and engineering from a bottom-up perspective.
His recent work has focused on applying a computational materials science approach to study materials failure in biological systems, including the investigation of material breakdown in a variety of diseases and other

extreme conditions across multiple time- and length-scales. His key contributions lie in the field of deformation and failure of structural protein materials such as collagen and silk, where his work revealed universal material design paradigms that enable protein materials to provide enhanced and diverse functionality despite limited resources (energy, material volume, weak building blocks such as H-bonds, etc.), and demonstrated how these mechanisms break down under extreme conditions and disease (impact, trauma, mutations, flaws, etc.). The impact of his work has been the establishment of the universality-diversity paradigm, explaining how multifunctionality (diversity) of material properties in biology is achieved by changing structural arrangements of few (universal) constituents rather than inventing new building blocks, or through reliance of the quality of building blocks. Some of Buehler's current work involves the use of ologs, a category-theoretic framework for knowledge representation, to encode the structure-function relationships inherent in hierarchical materials. Buehler has published more than 300 articles on theoretical and computational modeling of materials using various types of simulation methods, a monograph on atomistic modeling, a book on Biomateriomics, several book chapters, and has given hundreds of invited lectures, keynote talks and plenary speeches. He collaborates broadly with experimental researchers in the United States, Europe and Asia. He serves as a PI and co-PI on numerous research grants, including several interdisciplinary research projects funded by the National Science Foundation, Department of Defense, and other organizations.

Awards and Recognitions (from Wikipedia):
Buehler received the National Science Foundation CAREER Award, the United States Air Force Young Investigator Award, the Navy Young Investigator Award, and the DARPA Young Faculty Award. Buehler was cited as one of the top engineers in the United States between the ages of 30-45 through invitation to the National Academy of Engineering-Frontiers in Engineering symposium of the National Academy of Engineering. In 2009, his work was recognized by the Presidential Early Career Award for Scientists and Engineers (PECASE), the highest honor bestowed by the United States government on young researchers in the early stages of their careers. He received the 2010 Harold E. Edgerton Faculty Achievement Award for exceptional distinction in teaching and in research scholarship, the 2010 ASME Sia Nemat-Nasser Award, the 2011 Thomas J.R. Hughes Young Investigator Award and the 2011 Rossiter W. Raymond Memorial Award. In 2011 he received the inaugural Leonardo da Vinci Award from EMI.

Selected Publications:
Buehler, M.J.; Kong, J.; Gao, H.J. Deformation mechanism of very long single-wall carbon nanotubes subject to compressive loading. J. Eng. Mater. Technol. 2004, 126, 245–249
Gao, H., Ji, B., Buehler, M. J., and Haimin, Y., 2004, “Flaw Tolerant Nanostructures of Biological Materials,” Mech. Chem. Biosyst.,1, pp. 37–52.
Markus J. Buehler, Yong Kong, Huajian Gao and Yonggang Huang, “Self-folding and unfolding of carbon nanotubes”, ASME Journal of Engineering Materials and Technology, Vol. 126, No. 1, December 2005, doi:10.1115/1.1857938
M. Buehler, Y. Kong, H. Gao, and Y. Huang, ASME J. Eng. Mater. Technol. 128, 3 (2006)
S. Cranford, M.J. Buehler, Int. J. Mater. Struct. Int. 3 (2009) 161–178
Xu, Z.; Buehler, M.J. Strain controlled thermomutability of single-walled carbon nanotubes. Nanotechnology 2009, 20, 185701.
Z. Xu, M.J. Buehler, Geometry controls conformation of graphene sheets: membranes, ribbons, and scrolls. ACS Nano. 4, 3869–3876 (2010)
Sen, D., Garcia, A., Buehler, M.J., 2011. Mechanics of nano-honeycomb silica structures: a size-dependent brittle-to-ductile transition. J. Nanomech. Micromech. 1, 112-118

Giesa T, Arslan M, Pugno NM, Buehler MJ. Nanoconfinement of spider silk fibrils begets superior strength, extensibility, and toughness. Nano Lett 2011;11:5038–46
J. Zang, S. Ryu, N. Pugno, Q. Wang, Q. Tu, M. J. Buehler, X. Zhao, Nat. Mater. 2013, 12, 321.
Zang, J., Ryu, S., Pugno, N., Wang, Q., Tu, Q., Buehler, M.J., Zhao, X., 2013. Multifunctionality and control of the crumpling and unfolding of large-area graphene. Nature Materials 12, 321–32