Influence of translational disorder on the Poisson's ratio of elastically isotropic two-dimensional solids

J.W. Narojczyk and K.W. Wojciechowski

Institute of Molecular Physics, Polish Academy of Sciences
M. Smoluchowskiego 17, 60-179 Poznań, Poland

Modern technology often requires designing materials of special properties, which are not commonly seen in nature. This work is focused on materials showing unusual elastic properties, *i.e.* exhibiting anomalous (negative) Poisson's ratio. Recently, such materials, called *auxetics*, have been a subject of increasing interest [1]. Effective design of such materials will be much easier when various mechanisms behind controlling properties of elastic media are known and understood. Studies of simple model systems constitute an important step in this direction.

In the present work results of studies of certain forms of disorder on microscopic level and their influence on macroscopic elastic properties of materials are discussed. The object of the study are simple models of mono-, di-, and tri-atomic rigid model molecules interacting through soft, site-site pair potentials. The studied models are considered in the static case only, *i.e.* at the temperature T=0 K. Short-range interactions between particles are assumed: only particles that have a common side of Dirichlet polygon do interact. Two kinds of the interaction potential are considered: the n-inverse-power one and the 6-12 Lenard-Jones potential. With a very simple computational method, sketched in [2], essential influence of various types of disorder (*e.g.* atomic size polydispersity and aperiodicity of molecular lattice) on elastic properties of the studied systems is revealed. It is shown that, typically [3-5], the Poisson's ratio increases with increasing disorder in the system and tends to it's extreme possible value when the interaction potential tends to a hard-body one.

[1] K.W. Wojciechowski, A. Alderson, K.L Alderson, B. Maruszewski and F. Scarpa, *Preface*, phys. stat. sol. (b) **244** (2007) 813-816, and references cited in that issue.
[2] J.W. Narojczyk and K.W. Wojciechowski, phys. stat. sol. (b) **244** (2007) 943
[3] K.W. Wojciechowski and J.W. Narojczyk, Rev. Adv. Mater. Sci. **12** (2006) 120
[4] J.W. Narojczyk and K.W. Wojciechowski, Mater. Sci-Poland **24**(4) (2006) 921
[5] J.W. Narojczyk and K.W. Wojciechowski, J. Non-Cryst. Solids **352** (2006) 4292

Name of the presenting author (poster session II): Jakub W. Narojczyk
e-mail address: narojczyk@ifmpan.poznan.pl
http://www.ifmpan.poznan.pl