Abstract Submitted for the DFD09 Meeting of The American Physical Society

Stress transfer through fibrous materials in wicking experiments<sup>1</sup> DARIA MONAENKOVA, TARAS ANDRUKH, KONSTANTIN KORNEV, Clemson University — Due to the recent progress in preparation of fibers and nanofibers with different properties, the idea of smart textiles attracts much attention. In many situations the probes and sensors are designed for bio fluid detection. The liquid penetration in fibrous materials causes their deformations including stretching, twisting, wrinkling, buckling etc. The most of researches on wicking properties of textiles are focused on determination of media permeability and ignore the specific features of fibrous materials. On the other hand the theoretical works on quantitative analysis of the deformation effects in porous materials filled with liquids are mostly focused on deformation of fully saturated samples. The fundamental understanding of the stress transfer through the fiber network is crucial for sensors development, but to the best of our knowledge, the stress analysis in the fibrous materials absorbing liquids has never been discussed in the literature. This paper sets a physical basis for analysis of absorption processes in nanotubular and nanofibrous materials. We study absorption of droplets by yarns and webs made of fibers, develop a theory which explains the stress distribution in fibrous materials and checked this theory on wicking experiments. The reported theory and experiments propose a new area of research on absorption-induced deformations of fibrous materials.

<sup>1</sup>We acknowledge support from NSF, grant number CMMI-0826067 and NTC, project M08-CL10.

Daria Monaenkova Clemson University

Date submitted: 08 Aug 2009

Electronic form version 1.4