Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Peculiarities in liquid phase of Styrene Butadiene rubber surface induced by Atomic Force Microscopy-assisted electrostatic nanolithography MINDAUGAS RACKAITIS, Bridgestone Americas, SERGEI LYUKSYUTOV, The University of Akron, DMYTRO KASHYN, PAVEL PARAMONOV, ROBERT MALLIK — Nanoscale surface changes are reported for styrene butadiene rubber (SBR) films (10-100 nm) using protocol derived from Atomic Force Microscopy (AFM) electrostatic nanolithography. Under appropriate tip bias conditions, the electric field magnitude induced in SBR films is of the order of 10^8-10^9 V m^{-1}, which is sufficiently large to initiate cross-linking in the rubber. Peaklike surface features, surrounded by a circular trough and a raised ring, are observed after completing AFMEN-based protocol. The nanostructure dimensions vary from 0.5-20-nm high and 50-200-nm in diameter. The topology of the nanostructures is attributed to the interplay between film thickness (10 nm and thinner) and the radial component electrostatic pressure. Modeling of the electric field based on the numerical solution of Laplace equation for cylindrical geometry suggests that non-uniformity of electric field plays an important role in nanostructure formation. The stability of the features which remain stable for days suggests cross-linking between macromolecules at the nanoscale.

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Date submitted: 21 Nov 2008 Electronic form version 1.4