"Study of adhesion and aging behavior of rubber blends analyzed under the Multiscale-Contact-Mechanics (MCM) and a theoretical kinetics framework of aging: Implications for their functionality"

Presenting author:

Nestor Rodriguez[1]

Co-authors:

Bo N. J. Persson[2]

1: BD-Medical R&D, Becton Dickinson and Co., Franklin Lakes, NJ 07419, US

2: Peter Grubber Institute, FZ Julich, 52425 Julich, Germany

Abstract

Rubber blends have a complex behavior and it had been the subject of theoretical modeling from long time. Seminal works by Han, Cole-Parmer, Cole-Cole, and others have been directed to elucidate the behavior of a blend from their viscoelastic behavior. Their composition, structure and properties have also an impact on their functional behavior, for example friction and adhesion. Persson's contact mechanics theory is an excellent theoretical frame to study such complicated functional behavior.

Using DMA-stress relaxation, Differential Scanning Calorimetry:Oxygen Induction Time, and tensile pull off forcewe have studied the impact of aging on the functional performance of butyl, styrene-butadiene, and Isoprene rubber blends.
The adhesion of the rubber blends to glass and polymer substrates is presented. The additional characterization by DMA and preliminary friction results from a Leonardo da Vinci experimental set-up (constant driving force) allow to pin point the origin of the adhesion changes during aging.

The friction force depends non-linearly on the load, which we attribute to the influence of adhesion on the area of real contact. The calculated dependency of the area of real contact on the load is compared with the experimental results.

Comparisons between the functional changes due to aging and kinetic modeling of the aging phenomena is also presented.

ACKNOWLEDGMENTS

The authors acknowledge the contributions of Katherine Chew (MIT student) for the help with the experiments on adhesion and DSC-OIT.

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