TITLE CHEMICAL MODIFICATION OF NATURAL RUBBERS FOR CONTROLLING SURFACE PROPERTIES
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ABSTRACT Natural rubber (NR) is found in Hevea brasiliensis and is composed of both rubber hydrocarbons and non-rubber constituents, especially proteins and phospholipids. The presence of these fractions in NR can markedly affect both adhesive and frictional properties of the rubber surface. Chlorination of NR is a practical method to obtain desirable properties. In this research, the surface modification of various vulcanized NRs using 2 and 4%wt sodium dichloroisocyanurate (DCI) were studied. These include WNR (whole natural rubber), CNR (commercial natural rubber), EWNR and ECNR (acetone soxhlet extraction after cross linking), and PNR (purified natural rubber). A study on synthetic polyisoprene (IR) was also carried out for comparison purposes. The surface energy of chlorinated vulcanized NRs and IR increased as a function of both chlorination time and DCI concentration. ATR-IR showed slight surface chlorination but greater oxidation which correlated well with non-rubber components. Indeed, scanning electron-energy x-ray dispersive spectroscopy or SEM-EDX demonstrated a higher introduction of atomic oxygen than that of atomic chlorine. The surface morphology of chlorinated rubbers was investigated by atomic force microscopy or AFM. It indicated that surface morphology and surface roughness varied with chlorination time and non-rubber components. The frictional properties, determined by lateral force microscopy or LFM, of both modified IR and NRs tended to increase from 0 to 30 min and dropped after 60 min of treatment time. The correlation between surface modification and frictional properties was related to 4 principles, surface energy, surface roughness, segmental motion of polymer chain, and surface hardness or surface stiffness. In addition, vulcanized NR was epoxidized and adhered with chloroprene rubber (CR). The optimum peel strength was attributed to the balance between chemical interactions and physical properties of epoxidized NR (ENR) surface.