Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Super stretchy polymer multilayer thin films with tunable gas barrier FANGMING XIANG, SARAH WARD, TARA GIVENS, JAIME GRUNLAN, Texas A&M Univ — Super stretchy multilayer thin film assemblies with tunable gas barrier were fabricated using layer-by-layer (LbL) assembly. Unlike ionically-bonded gas barrier coatings that exhibit mud-cracking after 10% strain, hydrogen-bonded polyethylene oxide (PEO) and polyacrylic acid (PAA) multilayer thin films show no cracking after 100% strain due to low modulus. It is believed that the exceptional elasticity of this thin film originates from the intrinsic elasticity of PEO and the moderate hydrogen bond strength between PEO and PAA. The oxygen transmission rate (OTR) of a 1.58 mm thick natural rubber sheet can be reduced 10 times with a 367-nm-thick PAA/PEO nanocoating. This gas barrier improvement is largely retained after 100% strain. The modulus and oxygen permeability of PAA/PEO assembly can be tailored through altering the assembling pH. By setting the assembling pH to 2.75, a 50% reduction in permeability can be achieved, while maintaining the elasticity of the assembly. These findings mark the first super stretchy gas barrier thin film, which is useful for elastomeric substrates designed to hold air pressure.

Fangming Xiang
Texas A&M Univ

Date submitted: 12 Nov 2014 Electronic form version 1.4