Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Rayleigh-Taylor Instability Analysis at Biobased Composite Interfaces[1] RICHARD WOOL, XINTIAN SU, Univ of Delaware — The Rayleigh-Taylor (RT) instability occurs when a light fluid (such as a gas) of density ρ_L forms an unstable interface with a heavy fluid of density ρ_H due to gravitational forces g in the heavy-over-light unstable configuration. The RT instability produces bubbles and spikes which grow with amplitude H $\sim$ [gkAt]$^{1/2}$ in the linear region (Hk<<1) which evolves in a complex manner in the non-linear region (Hk>>1). Here, the wavenumber k = $2\pi/\lambda$, λ = wavelength between instabilities, t = time, and the Atwood number A = (ρ_H-ρ_L)/ ($\rho_H + \rho_L$). The RT instability is common in Inertial Confinement in Fusion reactors, Super Novas and for the first time reported here, in the interface of natural fibers with a liquid molding resin (soyoil) where the gas emitted from the natural fibers at T >100 °C explicitly forms and traps the bubbles and spike instabilities in the curing resin. The non-equilibrium spikes that form with A = 0.999 (Hk>1) are self-similar and behave as H = $H_\circ + \beta\lambda$, where the initial instability height $H_\circ$ = 11.6 micron and β = 0.6 for small spikes (<50 mum) and β =1.8 for larger spikes (>50 μm). The RT spikes are used to tailor the permeability (*breathability*) of the eco-leather like materials made with natural fibers and plant oils, where gas diffusion occurs by percolation along the natural fiber-spike interfaces. The eco-leather has substantially lower toxicity compared to natural leather, polyurethane and PVC (Funded by EPA).

[1]Supported by EPA and ELC.

Richard Wool
Univ of Delaware

Date submitted: 12 Nov 2014 Electronic form version 1.4