Abstract Submitted
for the TSF16 Meeting of
The American Physical Society

Effect of Crystal Orientation Upon the Surface Energy of Native Oxides on Si(100) and Si(111) as Measured by Three Liquid Contact Angle Analysis (3LCAA)[1] R.T. VAN HAREN, E. OCAMPO LANDEROS, M.T. BADE, A.O. MARTINEZ, Y.W. PERSHAD, S.M. SUHARTONO, R.P. FRANCIS, Ariz. St. Univ. Physics, N. HERBOTS, S.D. WHALEY, Ariz. St. Univ. Physics/ SiO2 Innovates, R.J. CULBERTSON, Ariz. St. Univ. Physics, H.L. THINAKARAN, A.P. KRISHNAN, BASIS HS Scottsdale — The surface energy γ^{T} of native oxides on Si(100) and (111) is measured via Three Liquid Contact Angle Analysis (3LCAA) to detect crystal orientation effects. Low surface roughness of Si wafers lowers γ^{T} via low density of dangling bonds, so γ^{T} scales with chemical reactivity freely from topography [1]. 3LCAA based on the Van Oss theory measures γ^{T} via surface interactions with molecular dipoles (Lifshitz-Van der Waals), labeled γ^{LW}, with electron donors, γ^{+}, and acceptors, γ^{-}. Surface energy components γ^{LW}, γ^{+}, and γ^{-} give insights into optimizing γ^{T} for hermetic NanoBonding^{TM}in sensors [1], to extend lifetime and reliability in saline environments from days to years via matching electronegativity in cross-bonding pairs. 3LCAA with 18 MΩ Deionized water, glycerine, and α-bromonaphthalene in a Class 100 hood and the Sessile Drop method yield for native SiO2/Si(111) γ^{T} = 56.7+/-2 mJ/m^2, and γ^{T} = 49.7+/-2 mJ/m^2 on Si(100), a 13% difference. Since Si(111) surface atomic density is 12% larger than Si(100), 3LCAA finds that γ^{T} scales with surface atomic density. [1] US9018077, granted 2015, *Herbots et al*

[1]Funded by SiO2 Innovates. Access to ASU's User Facilities in the Ion Beam Analysis for Materials (IBeAM) Lab is gratefully acknowledged.

R.T. Van Haren
Ariz. St. Univ. Physics

Date submitted: 09 Sep 2016 Electronic form version 1.4