Abstract Submitted
for the 4CF15 Meeting of
The American Physical Society

**Measuring Surface Energy and Reactivity for Wet NanoBonding$^{TM}$ via Three Liquid Contact Angle Analysis** ENDER W. DAVIS, NICOLE HERBOTS, ROBERT J. CULBERTSON, ALEX L. BRIMHALL, ASHLEY A. MASCARENO, Arizona State Univ Dpt of Physics, CLARIZZA F. WATSON, SiO2 NanoTech LLC, NITHIN KANNAN, ABIJITH KRISHNAN, Arizona State Univ Dpt of Physics/BASIS HS Scottsdale, MATTHEW T. BADE, Arizona State Univ Dpt of Physics/Brophy College Prep, SIO2 NANOTECH COLLABORATION — Silicon-based surfaces, such as thermally-grown amorphous a-$SiO_2$ and Si(100), are hermetically bonded using wet NanoBonding$^{TM}$. Initial surfaces are modified to favor electron exchange and cross-bonding. a-$SiO_2$ is etched with hydrofluoric acid (HF), while $\beta$-c$SiO_2$ is grown on Si(100). Next, both are NanoBonded under steam pressurization. NanoBonding can bond medical, marine, and air sensors to their electronics, and be used in night vision goggles and solar cells. To optimize cross-bonding, surface energy $\gamma^T$ is studied via 3 liquid contact angle analysis (3LCAA) and the Van Oss theory. This models $\gamma^T$ via 3 components: $\gamma^{LW}$ for dipole interactions, $\gamma^+$ for electron donors, and $\gamma^-$ for acceptors. 3LCAA extracts contact angles from 3 liquids with known surface energies: water, glycerin, and $\alpha$-bromonaphthalene. We use several droplets of each liquid on the surface to improve accuracy. $\gamma^+$ accounts for little to none of the surface energy of all surfaces, but the annealing in Wet NanoBonding significantly increases $\gamma^+$ in $\beta$-c$SiO_2$. Conversely, HF etching significantly increases $\gamma^-$ for a-$SiO_2$. This donor/acceptor imbalance enhances reactivity and NanoBonding between the surfaces.

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Date submitted: 02 Sep 2015 Electronic form version 1.4