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Corroborating $LiTaO_3$ Surface Energies Measured by Three Liquid Contact Angle Analysis (3LCAA) with Computed Gibbs Energy for Wafer Bonding Engineering SHEFALI PRAKASH, ABBIE ELISON, SRIVATSAN SWAMINATHAN, RILEY RANE, MOHAMMED SAHAL, BRIAN BAKER, LAUREN PUGLISI, SAAKETH NARAYAN, ROBERT CULBERTSON, NICOLE HERBOTS, Arizona State University Department of Physics, PROF. HERBOTS NANOBONDING RESEARCH GROUP TEAM — LiTaO3's piezo- and opto-electrical properties make its monolithic integration to Si key to the Internet of Things. In this work, Nano-Bonding (NB) uses Surface Energy (SE) Engineering to cross-bond $LiTaO_3$ and Si/SiO_2 at RT by engineering their surface energies and their hydro-affinity into far-from-equilibrium via Three Liquid Contact Angle Analysis (3LCAA). SE are found to average 41 +/- 2 mJ/m^2 for hydrophobic $LiTaO_3$, while wet etching yields 49 +/- 1.5 mJ/m^2 for hydrophilic SiO_2, and 53 +/- 0.2 mJ/m^2 for hydrophilic Si. Thus hydrophobic-hydrophilic pairs can be engineered. $\Delta G_{LiTaO3-SiO2}$ computed from SE is found to be negative at -8.18 mJ/m^2 while $\Delta G_{\ LiTaO3-SiO2}$ is -0.46 mJ/m^2 at RT. Negative ΔGs favor bonding of hydrophobic $LiTaO_3$, to hydrophilic Si and SiO_2.

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