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Comparative Study of Surface Energy Engineering for low temperature wafer bonding on $LiTaO_3$ and $LiNbO_3$ to Si and SiO_2 MOHAMMED SAHAL, BRIAN R BAKER, NICOLE HERBOTS, NIKHIL C SURESH, SHAURYA KHANNA, AMBER A CHOW, SAAKETH NARAYAN, AASHI R GURIJALA, SUKESH RAM, Arizona State University, NICOLE HERBOTS RESEARCH GROUP TEAM — Surface engineering is needed to directly bond wafers of $LiTaO_3$ (100) and $LiNbO_3$ (100), Si (100) and SiO_2 (100). Surface Energy Engineering (SEE) can be designed using the Van Oss-Chaudhury-Good for wafer mapping of three surface interactions, namely van der Waals interactions, and interactions with electron donors and acceptors. Three liquid contact angle analysis (3LCAA^{TM}) was developed for Nanobonding^{TM} using several drops for each of liquids (Water, α-bromo naphthalene, glycerin) for contact angle measurements. The DROP^{TM} algorithm is a fast, accurate way to extract contact angles. Surface engineered hydrophobic $LiTaO_3$ (100) bonding to hydrophilic Si (100) is attempted for electron donor-acceptor low temperature direct bonding. Hydrophilic-hydrophilic hydrogen bonding at low temperature is found to require hydrophilic $LiTaO_3$ and $LiNbO_3$.

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