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™) was developed for Nanobonding™ using several drops for each of liquids (Water, α-bromo naphthalene, glycerin) for contact angle measurements. The DROP™ 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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