

## 5<sup>th</sup> Quarterly Report – Public Page

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For this quarter, a large majority of work has been completed regarding the long term adhesion degradation testing. Pull-off adhesion data has been collected for the first three months of water exposure. The data appear to possess a large amount of standard deviation and the causes for this have been determined. New methodology for evaluating adhesion that eliminates many of the observed issues with pull-off testing is discussed. The methodology will be evaluated and tested for validity within the next quarter while pull-off tests will continue to serve as a basis for comparison. The environmental chamber has been made operable and hygrothermal cycling of samples will begin in the next quarter. Experiments were designed and carried out to investigate the relaxation of the residual stress in 3LPE coating/thin steel strip systems. Results show that a temperature of approximately 106 °C is sufficient to induce full relaxation of the 3LPE coating. Finite element modeling was carried out to explore the effect of FBE coating thickness on curvature of thin steel strips in both single layer FBE and 3LPE scenarios. The results show that the experimentally observed temperature of 106 °C yields better agreement between the modeling and experimental results, but small discrepancy still exists, possibly due to inaccurate material parameters (modulus, coefficient of thermal expansion, etc.) or over-simplification of the modeling, or both. Even so, the correlation and trends between the experiments and modeling is considered acceptable. The curvature of the 3LPE systems is the same due to dominating effects from the thick HDPE topcoat layer. The effect of cutback angle was also observed and it was found that an angle of 30° gives significantly less residual stress in the cutback region compared to an angle of 90°.