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Progresses to date:

Multi-layer coating is a popular construction approach to protect against corrosion for oil/gas pipelines. These coatings are typically applied on the steel substrate at high temperatures. As the multi-layer pipeline coatings cool down, high residual stresses develop. These processing-induced residual stresses on the coating layers are detrimental to the integrity of the multi-layer coatings, especially when inadequate steel substrate surface preparation procedures are applied. The goals of this research are (1) to understand the source(s) and mechanism(s) for the formation of residual stresses, (2) to study the interfacial degradation between the coating and the steel substrate, and (3) to predict multi-layer pipeline coating disbondment based on numerical modeling.

In the literature, the residual stresses of organic coatings have been reported for thin liquid coatings applied on thin metal strips. ASTM has just published a new standard, entitled “Standard Test Method for Measurements of Internal Stresses in Organic Coatings by Cantilever (Beam) Method”, following the work of E. M. Corcoran in 1969. This test method is applicable only to thin coatings on thin steel strips. For thick multi-layer coatings, this test method needs to be modified. We have identified possible test methods to measure residual stresses for thick multi-

layer coatings. In addition to the experimental measurments, we will adopt finite element analysis (FEA) to estimate the build-up of residual stresses. The calculated stresses based on FEA will be correlated with experimental results to establish a valid numerical model for the prediction of formation of residual stresses in multi-layer pipeline coatings.