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Direct Equivalent Stress Investigation Model of STS316L Steel by Small Punch Creep Testing

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Abstract—Small punch creep testing methodology has superiority over the conventional uniaxial creep test as it utilizes only a small sized specimen (10 X 10 X 0.5 mm) which can easily be acquired even from the in-service facilities without harm. In this paper the equivalent strain ε_q, minimum creep strain rate $\dot{\varepsilon}_{min}$ is calculated from SPCT, the correlation factor K_{sp} for stress of STS 316L Steel is studied and an mathematical model is devised for direct calculation of equivalent stress σ_{eq} directly from small punch creep test load utilizing Larson-miller parameter model for STS 316L steel. The calculated equivalent stress is cross validated by plotting it against the uniaxial creep test stress and Larson-miller parameter. After the calculation they are used to analyze the creep lifetime in different creep life expectancy models and the results show good agreement and it can conclude that using this equation/model we can directly calculate the equivalent stress σ_{eq}. By using the creep life models we can also calculate/predict the expected creep life of the material.

Keywords—Creep Life Prediction, Small punch creep test (SPCT), Uniaxial creep test (UCT), Monkman-Grant Model, Larson-miller Parameter (LMP)