An improved energy-based model for predicting the fatigue life of the automobile sealant adhesively bonded butt-joints

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Abstract

The evolution of dissipation energy of the uniaxial and multiaxial fatigue experiments on the automobile sealant adhesively bonded butt-joints was investigated by the method of fatigue dissipation energy analysis and fatigue failure identification. The results demonstrated that the dissipation energy increased and the fatigue life decreased with the increase of stress amplitude, mean stress, and the decrease of cycle time. Meanwhile, the non-proportional loading path resulted in greater dissipation energy and shorter fatigue life than that of uniaxial and proportional loading path. Moreover, the existing energy-based model using the energy dissipated in different cyclic loading stages as the fatigue parameters was adopted to predict the fatigue life of the automobile sealant adhesively bonded butt-joints, respectively. The practical limitations of the prediction model using the total dissipation energy as the fatigue parameter were evaluated. Therefore, an improved energy-based fatigue life prediction model was proposed which using the partial steady stage of dissipation energy curves as the parameters. The predicted results of the improved model and the comparison with that of the existing energy-based model indicated that the improved model had an excellent ability to predict the fatigue life, and was more practical in engineering application for the automobile sealant adhesively bonded butt-joints.

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