



PVC涂层膜材料不同应力下非线性蠕变特性的预测

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A PREDICTION METHOD OF NONLINEAR CREEP BEHAVIOR OF PVC COATED FABRIC MEMBRANE AT DIFFERENT STRESSES

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摘要

对方平组织为基布的PVC (polyvinylchloride)涂层膜材料进行了经、纬两方向五种应力条件下的拉伸蠕变试验. 利用七参数(四个蠕变柔量与三个推迟时间)广义Kelvin-Voigt线性粘弹性蠕变模型对试验数据进行了分析, 从中发现: 对于单个应力, 线性粘弹性蠕变模型具有很好的拟合效果, 而对于多个应力, 三个推迟时间参数保持不变, 并以此为基础, 将七参数广义Kelvin-Voigt线性粘弹性蠕变模型修改为适合膜材料的七参数(四个蠕变柔量与三个推迟时间)非线性粘弹性和十四参数(八个蠕变柔量与六个推迟时间)非线性粘弹塑蠕变模型, 并把十四参数非线性粘弹塑蠕变模型合并为四个蠕变柔量与三个推迟时间的七参数非线性模型, 再将这两种非线性模型中的三个推迟时间设定为与线性粘弹性蠕变模型相同, 同时还设定非线性部分均来自于四个蠕变柔量, 最后借助四阶多项式对不同应力与对应的蠕变柔量进行了拟合, 结果发现: 该方法可以很好预测其他应力的蠕变特性.

关键词: [PVC 涂层膜材料](#) [蠕变](#) [多项式函数](#) [非线性](#) [数据拟合](#)

Abstract:

The uniaxial tension creep tests for PVC (polyvinylchloride) coated fabric membranes of 2/2 plain weave were carried out along the warp and weft directions at five different stresses states. By mean of the generalized Kelvin-Voigt linear viscoelastic creep model with seven parameters (four compliance components and three retarded time), the experimental data were analyzed. The results revealed that there had been good fitting effect for the linear model at single stress and three retarded time had been maintained at multiple stresses. On these bases, the linear viscoelastic model was modified into a nonlinear viscoelastic model with seven parameters (four compliance components and three retarded time) and a nonlinear visco-elastic-plastic model with fourteen parameters (eight compliance components and six retarded time). The latter was amalgamated into a nonlinear model with seven parameters (four compliance components and three retarded time). Considering that the three retarded time of the nonlinear models were the same as the linear model, that the nonlinear factors were come from four compliance components, the experiment data was analyzed with the aid of 4th degree polynomial. The result showed that the method could give better prediction at other stresses.

Key words: [PVC coated fabric membrane material](#) [creep](#) [polynomial function](#) [nonlinear](#) [data fitting](#)

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