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Tensile-relaxation study of camel hair fiber at elastic stretching region: Analytical model and experiment

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Abstract: Tensile-relaxation is important in processing α-keratin hair fibers. This study proposed a composite structure model for camel guard hair, which composes of non-consistent crystalline phase with linked fibrils in amorphous matrix. The structure model was used to interpret the specific tensile-relaxation manners of camel hair under dry, wet, halide and reductant ions treated conditions. Based on the structure model, an analytical model was proposed to predict the relaxation of stretched camel hair using parallel ideal spring and dashpot in series with a spring. The disintegration of crystalline phase was assumed to become one more parallel of spring and dashpot in addition to the original model. In cycles of tensile-relaxation test, the modulus and viscosity of spring and dashpot were obtained from the first relaxation manner. The following relaxation decays were thereafter analytically predicted, and verified by experimental data. It was found a good agreement from the comparison with less than 10% of error, indicating the assumption and prediction of the analytical model reasonable and acceptable.

Keywords: Camel hair, composite structure, tensile, relaxation, analytical model

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