Materials such as asphalt, polymers or the Earth's crust tend to behave in a way that can be described neither with a model of viscous fluid, nor a model from solid mechanics. There are indeed models capable of capturing these so called viscoelastic phenomena far better, but they are based on the presumption of constant temperature. In many cases, e.g. in the glass industry or in geophysics, the properties of a viscoelastic material strongly depend on temperature. That is why it is precisely these changes that need to be described. There are viscoelastic models used in practice that take into account the material parameters' dependence on temperature, however, they do not consider the viscoelastic nature of the material when describing the temperature evolution. The objective of this thesis is to derive thermodynamically consistent viscoelastic models with temperature dependent parameters and the appropriate evolution equation for temperature, implementation of the models and computing simple test simulations.