The influence of different nitrocelluloses on the interaction in a binder-plasticizer system

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Abstract

The interaction between a binder and a plasticizer is a complex matter, especially if the binder is nitrocellulose. One of the reasons for this is the varying degree of substitution of the hydroxyl groups along the individual chains. The aim of this study is to provide insight into the interaction between various energetic and non-energetic plasticizers and a variety of different nitrocelluloses from different manufacturers with the nitrogen content ranging from 11.6 to 13.4%. After characterizing the available nitrocelluloses with regards to crystallinity, molecular weight distribution, viscosity and a variety of other properties they are mixed with the plasticizers in a solvent process. To cover a wide range of compositions small scale experiments with only a few grams of nitrocellulose are conducted. As a first step the obtained gels are then analyzed by Differential Scanning Calorimetry (DSC) and Fourier-transform Infrared Spectroscopy (FT-IR). DSC is applied to measure the glass transition temperature since it depends strongly on the way binder and plasticizer interact with each other. For small amounts of plasticizer the influence of the nitrocellulose on the glass transition temperature is almost as strong as that of the plasticizer (fig. 1). Another way to obtain information about the interaction between binder and plasticizer is FT-IR because a varying intensity of the interaction will result in a shift of the wave number of the respective functional group. This poster presents the first results of these investigations.

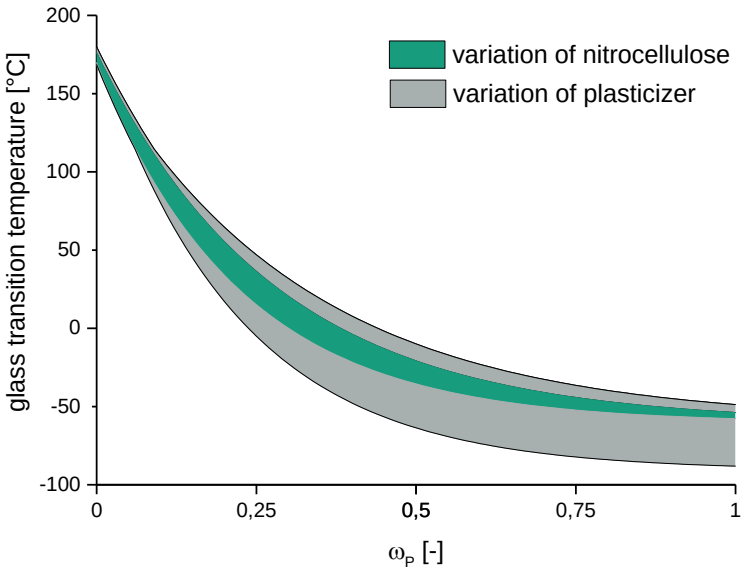

Fig. 1: Influence of nitrocellulose and plasticizer on the glass transition temperature depending on the weight fraction of plasticizer ω_P. Green area: glass transition temperature for DNDA-57 as plasticizer and different nitrocelluloses; grey area: glass transition temperature for a fixed nitrocellulose (12,6 %N) and different plasticizers