Linear rheology of cross-linked polypropylene oxide as a pressure sensitive adhesive - DTU Orbit (10/11/2019)

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Soft polymer networks are commonly used as pressure sensitive adhesives (PSAs). This is due to their unique ability to deform and yet to resist flow. These contradictory requirements indicate that the mechanical properties are finely tuned, and that the types of deformation upon application are carefully considered. Two main mechanisms must be considered when studying adhesives, that is the debonding and bonding mechanisms. Linear rheology is used to study the debonding mechanisms to gain better understanding of the peeling process of the PSAs. A variety of PSAs are prepared by mixing a linear vinyl terminated polymer with a silane terminated f-functional cross-linker, with $f > 2$. The stoichiometric imbalance, $r$ (silane to vinyl ratio), the molecular weight of the linear polymer, $M$, and the cross-linker functionality, $f$, are used as adjustable parameters to tune the properties of the cross-linked networks. The adhesive performance was tested with 90 degrees peel tests at three peel rates and thicknesses, and it was observed that the peel force varies with $r$, $M$ and $f$ and also the peel rate. The fundamental viscoelastic parameters that govern the PSA performance of cross-linked systems were used to state an empirical relation for the peel force. The relation is combining the peel force with the loss tangent at the peel frequency and the equilibrium modulus. Based on this, basic guidelines for selecting the appropriate polymer/cross-linker system to achieve the target performance are given.

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