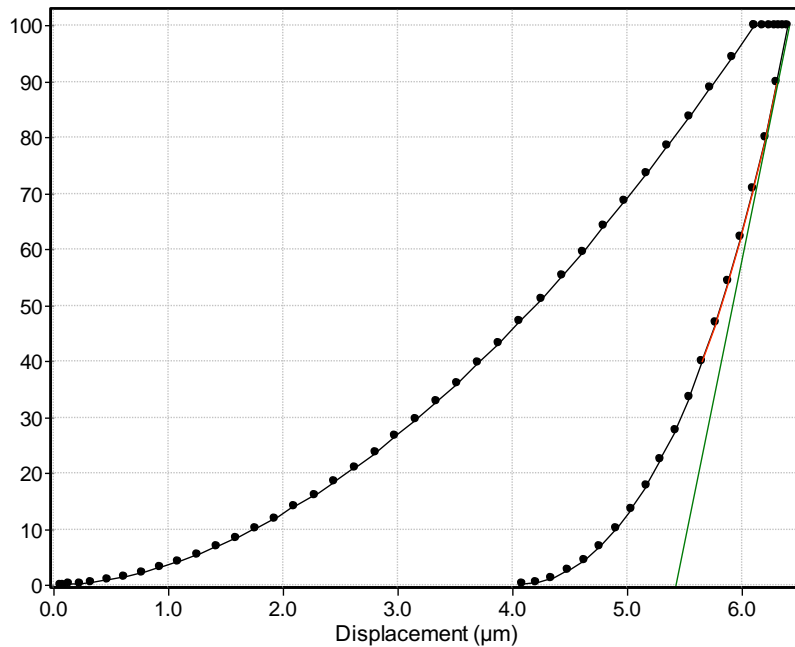


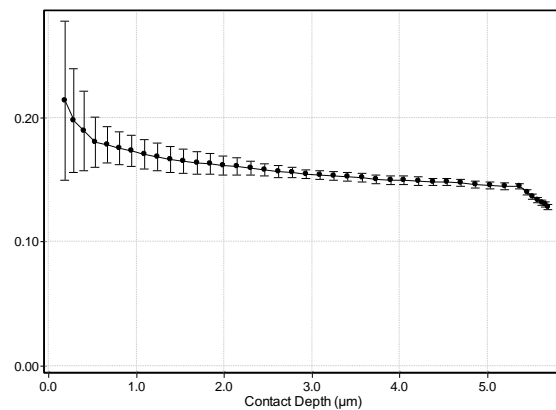
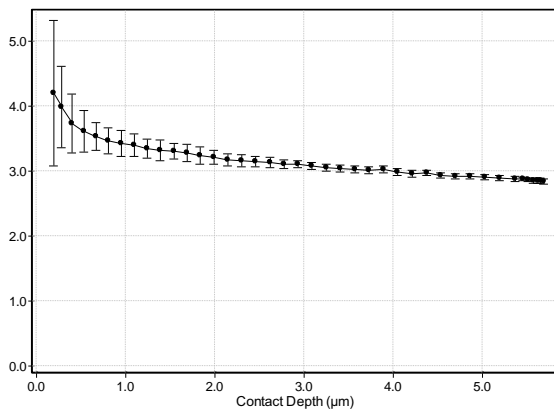
Time Dependent Mechanical Properties - A FilmDoctor[®] Application

Full story at www.siomec.de/pub.

**1st Step: QCSM into Polymer using ASMEC's UNAT[®]
 courtesy Dr. Thomas Chudoba, ASMEC**



Standard analysis with classical O&P results in the following Young's modulus and hardness functions.

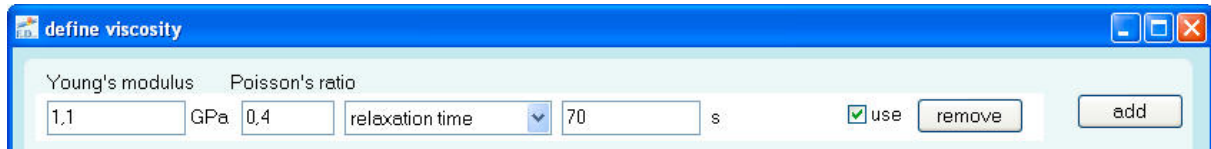


2nd Step: Reevaluation and fit with extended O&P method, taking time dependent mechanical parameters into account (also possible for layered structures)

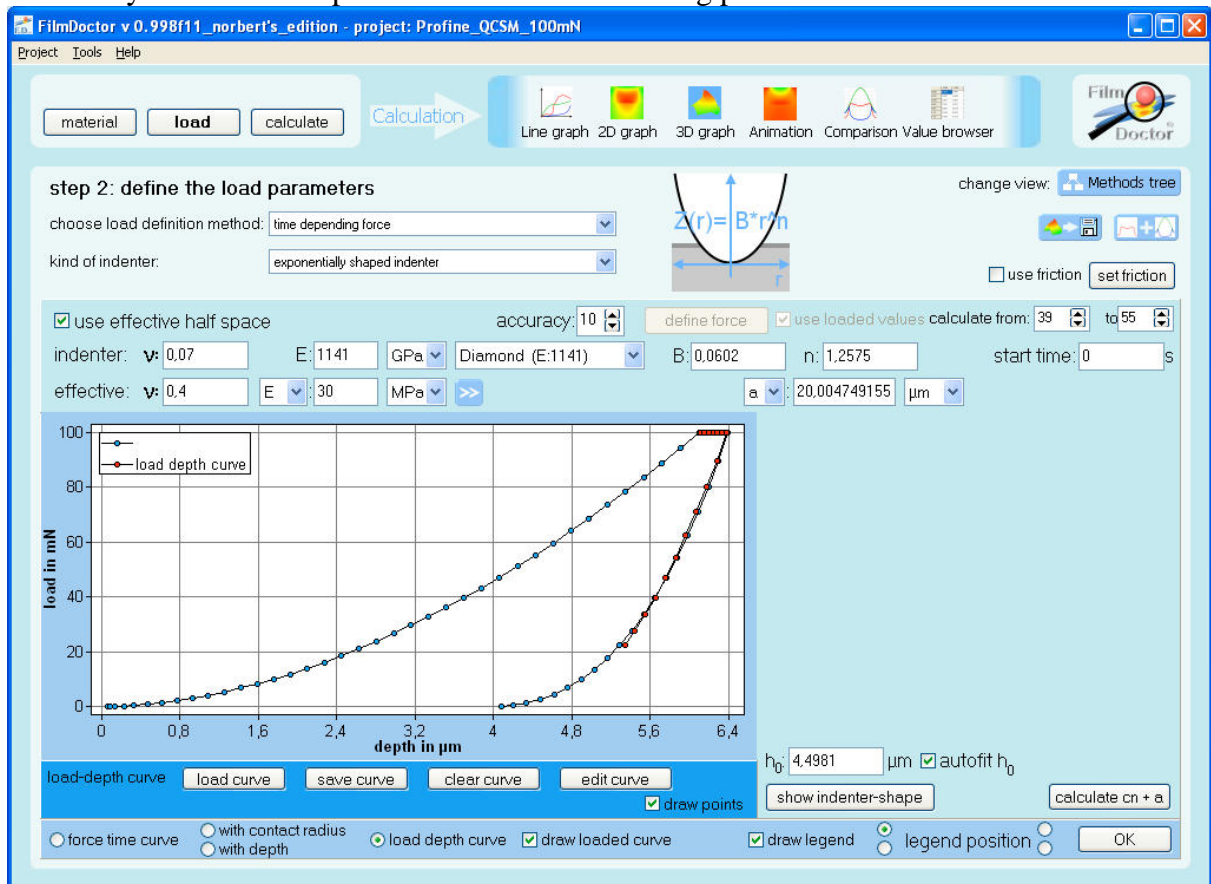
By applying the most simple approach for the time dependent Young's modulus with

$$E(t) = E_s + \sum_{i=0}^N E_{vi} * e^{-\frac{t}{\tau_i}},$$

setting $N=0$, $E_s=30\text{MPa}$, $E_{v0}=1.1\text{GPa}$ and $\tau_0=70\text{sec}$



we already obtain an acceptable fit even for the holding period.



Comparing with the results from the classical O&P analysis, we find significantly different Young's moduli and also the hardness drops from 128MPa (classical O&P method) down to 79.6MPa (time dependent analysis), which is a quiet notable difference.

To conclude → measuring the mechanical properties of materials showing significant creep (like Polymers) requires an extended Oliver and Pharr method taking the time dependent Young's modulus into account.

