Examples for the time dependent effective indenter concept

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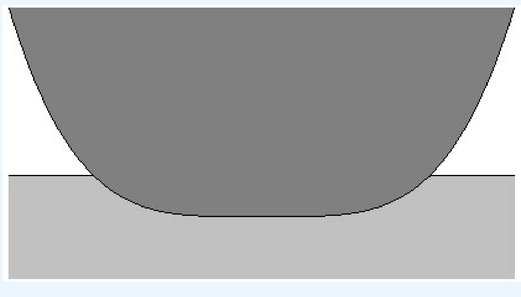
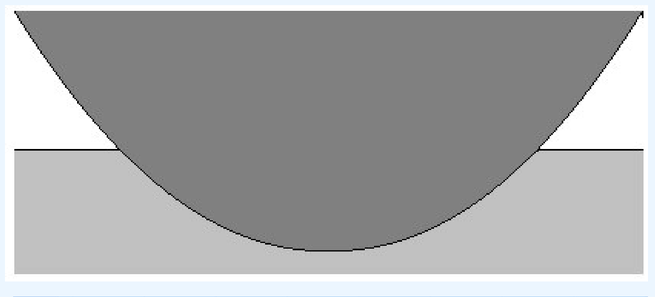
Motivation

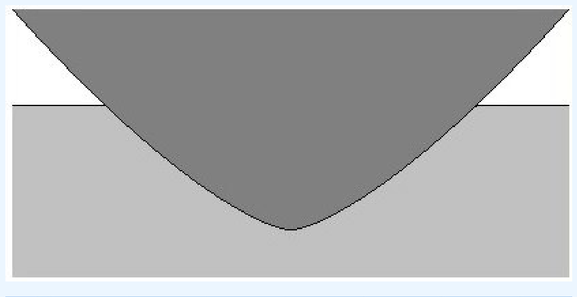
In many real work situations materials show time dependent behaviour. These can be caused by viscouse material properties or high temperatures. These temperatures can be caused by friction or high environment temperatures for example.

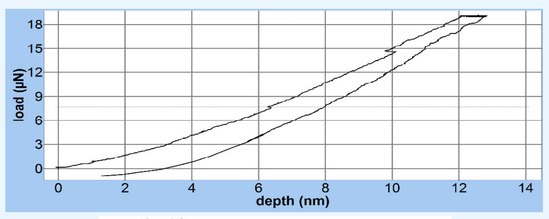
To optimize your materials you have to know as much as possible about your material behaviour and take this knowledge into account.

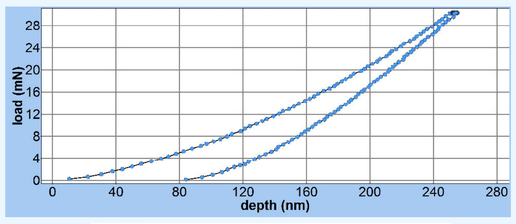
Examples

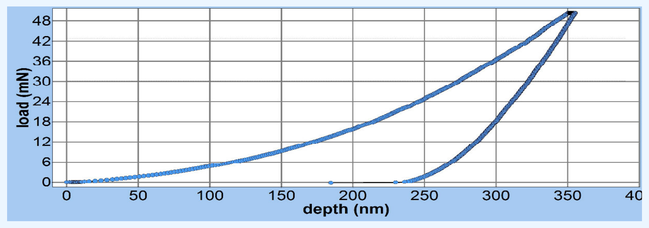


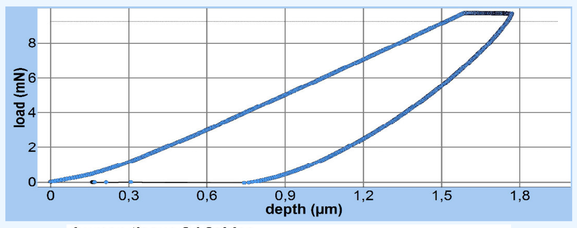


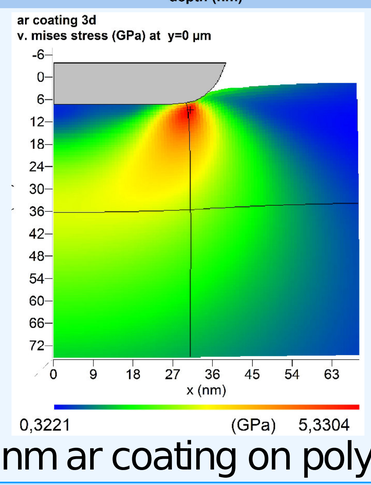




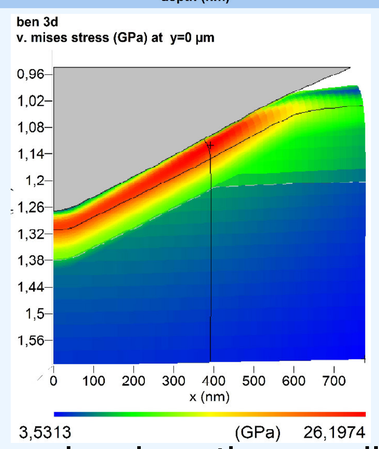




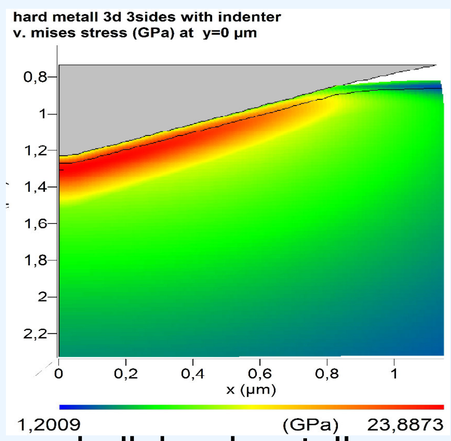




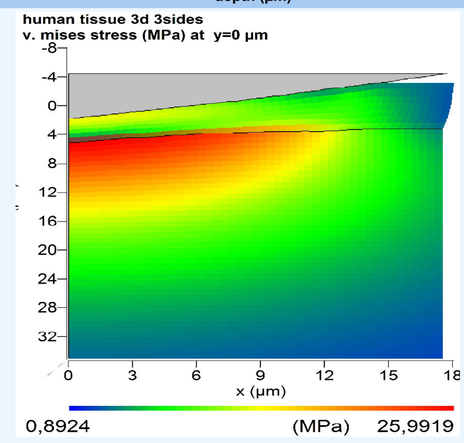
250 nm ar coating on polymer



1,1 µm hard coating on silicon



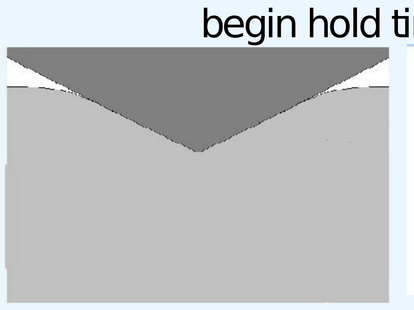
bulk hard metall

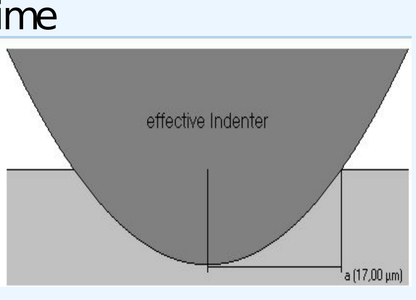


5µm human tissue on glas (n<2)

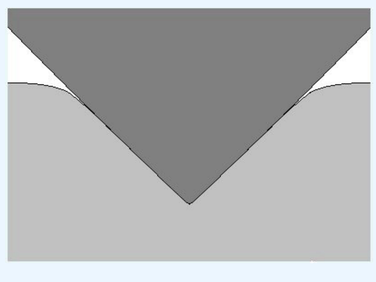
Contact changes over time

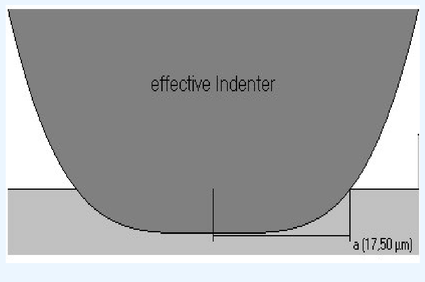
begin hold time



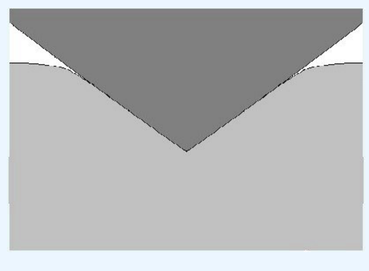


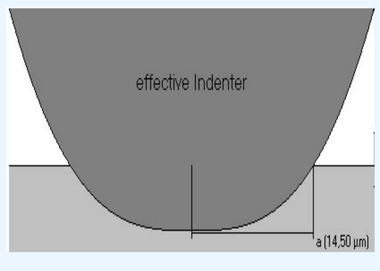
end hold time

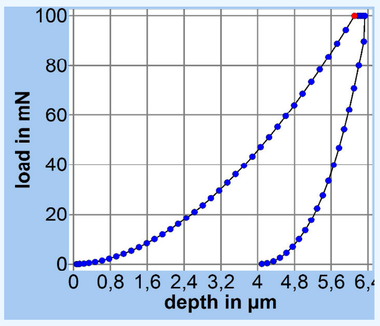


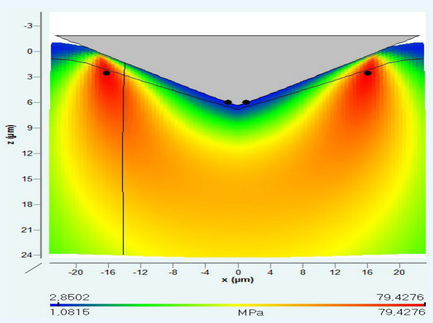


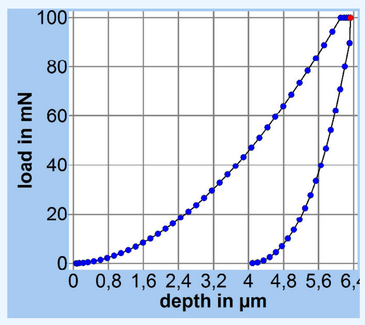
end unloading

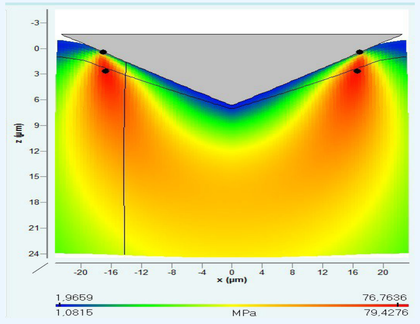


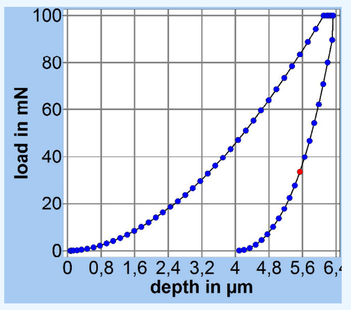


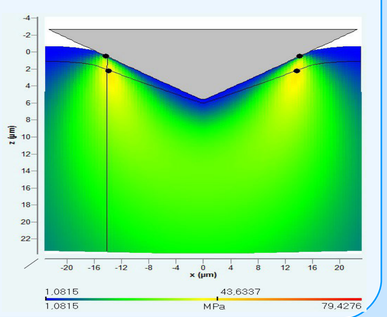












Conclusion

To analyze the measurements correctly, temperature fields, temperature and time depending mechanical parameters must be taken into account. With actual devices like MicroMaterials' NanoTest hot stage, these temperature dependent parameters can be measured.

SIO® has developed analytical models, which take temperature-sensitive and time-depending mechanical parameters and temperature fields into account, and has implemented them in the software FilmDoctor®. For more information please visit www.siomec.de/FilmDoctor.

Normal stress distribution *

Von mises stress distribution with indenter *

”creepy”/viscose scratch test

The 2 screenshots show the stress distributions for the same moment during a scratch test. We selected the von Mises and the normal stress in direction of indenter movement.

* Absolute values changed for NDA reasons.

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Benefits

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- ✔ Allows you to optimize your materials faster
- ✔ Allows more precisely lifetime prediction
- ✔ Ward off unjustified customer complaints

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