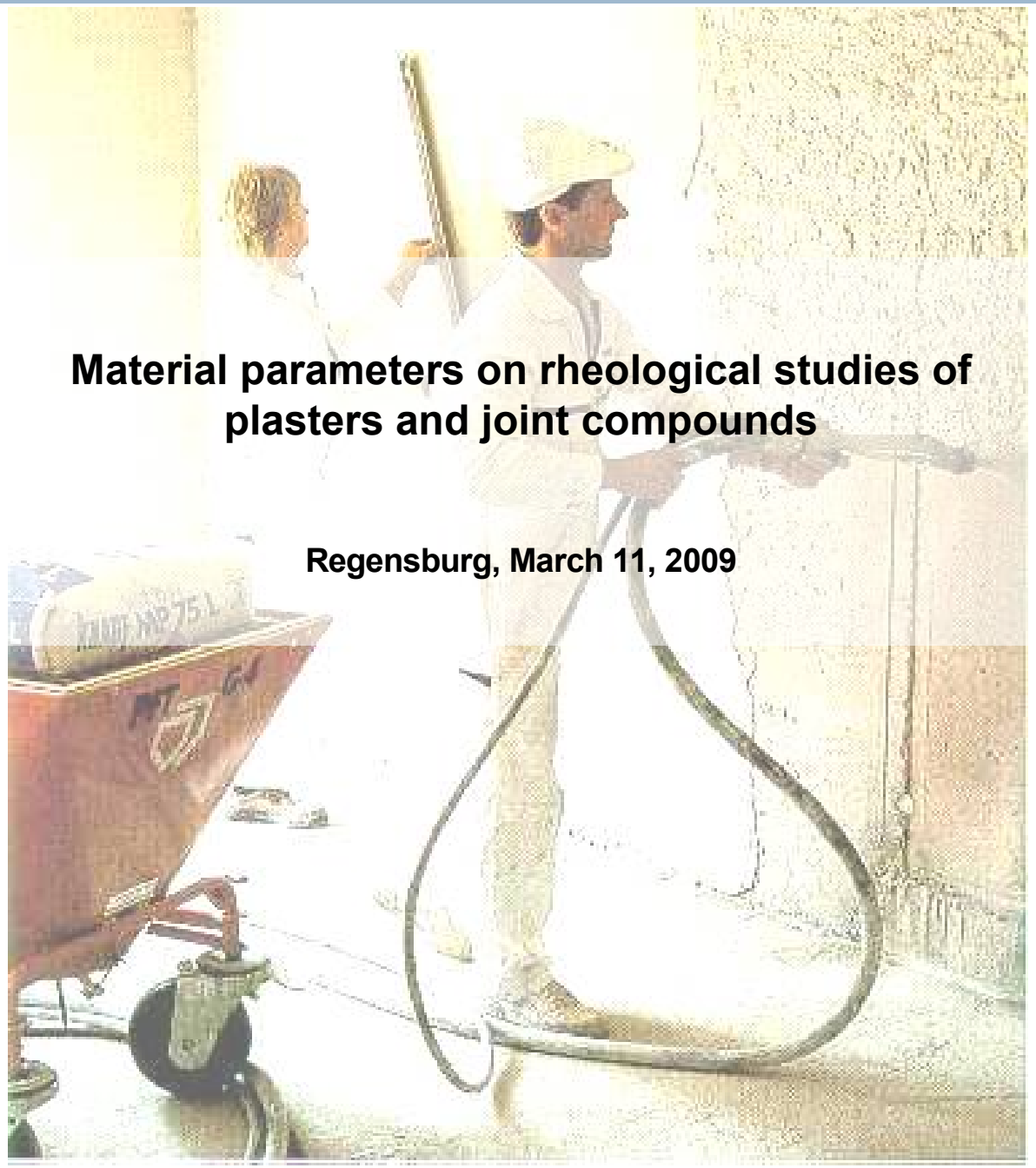


Material parameters on rheological studies of plasters and joint compounds

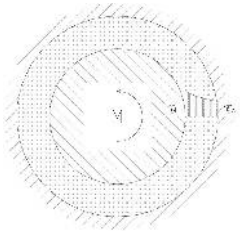
Regensburg, March 11, 2009


KNAUF MP 75 L

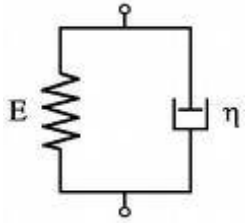
18. Congress of rheological measurements on building materials

Material parameters on rheological studies of plasters and joint compounds

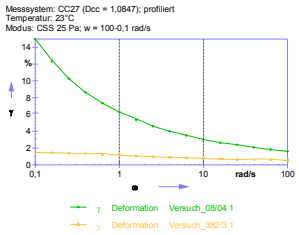
Overview



Controlled shear stress of viscoelastic solids in concentric cylinders



Basics on rheology of sinusoidal oscillations



Example of estimation of joint filler stability

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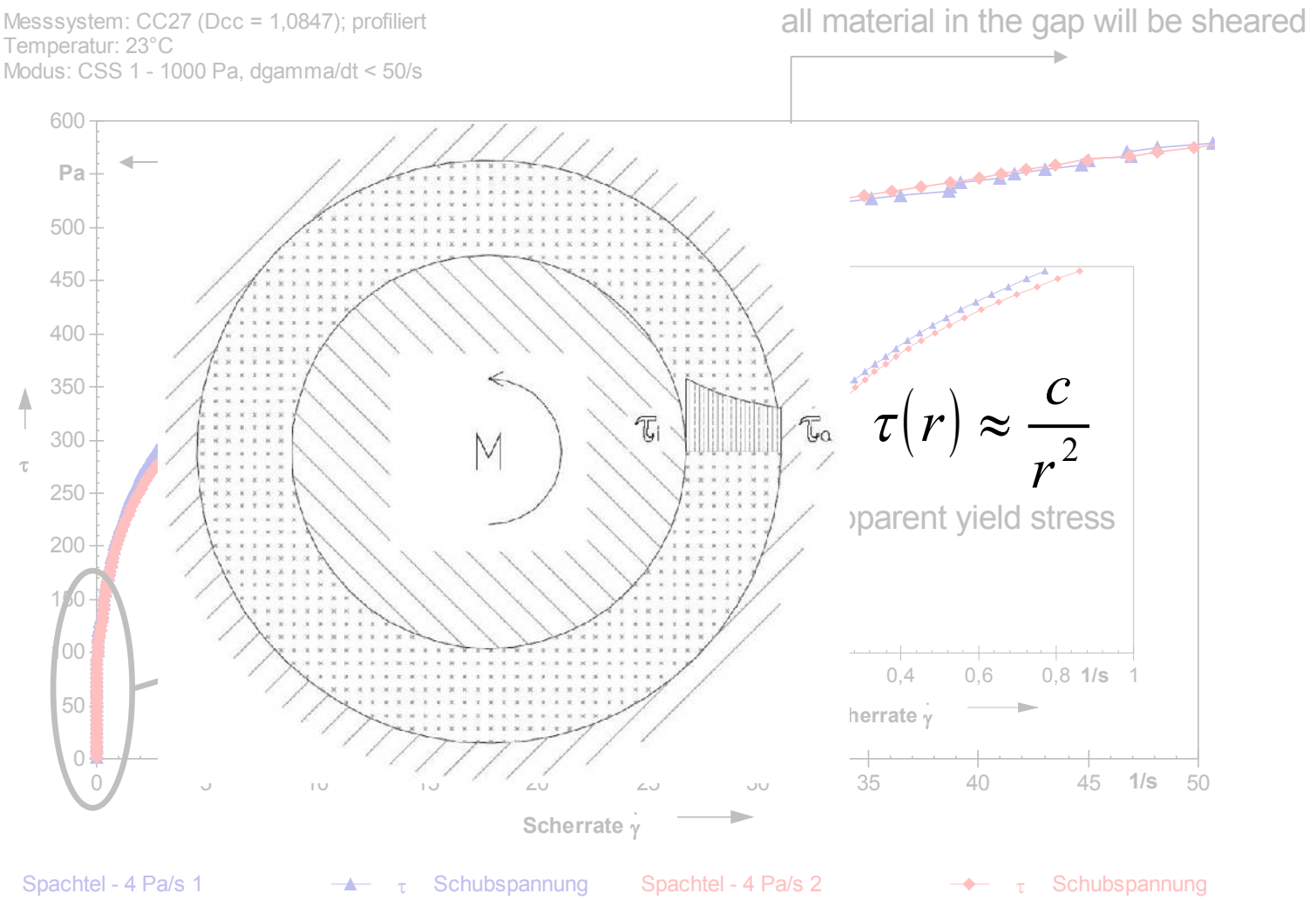
Part: I



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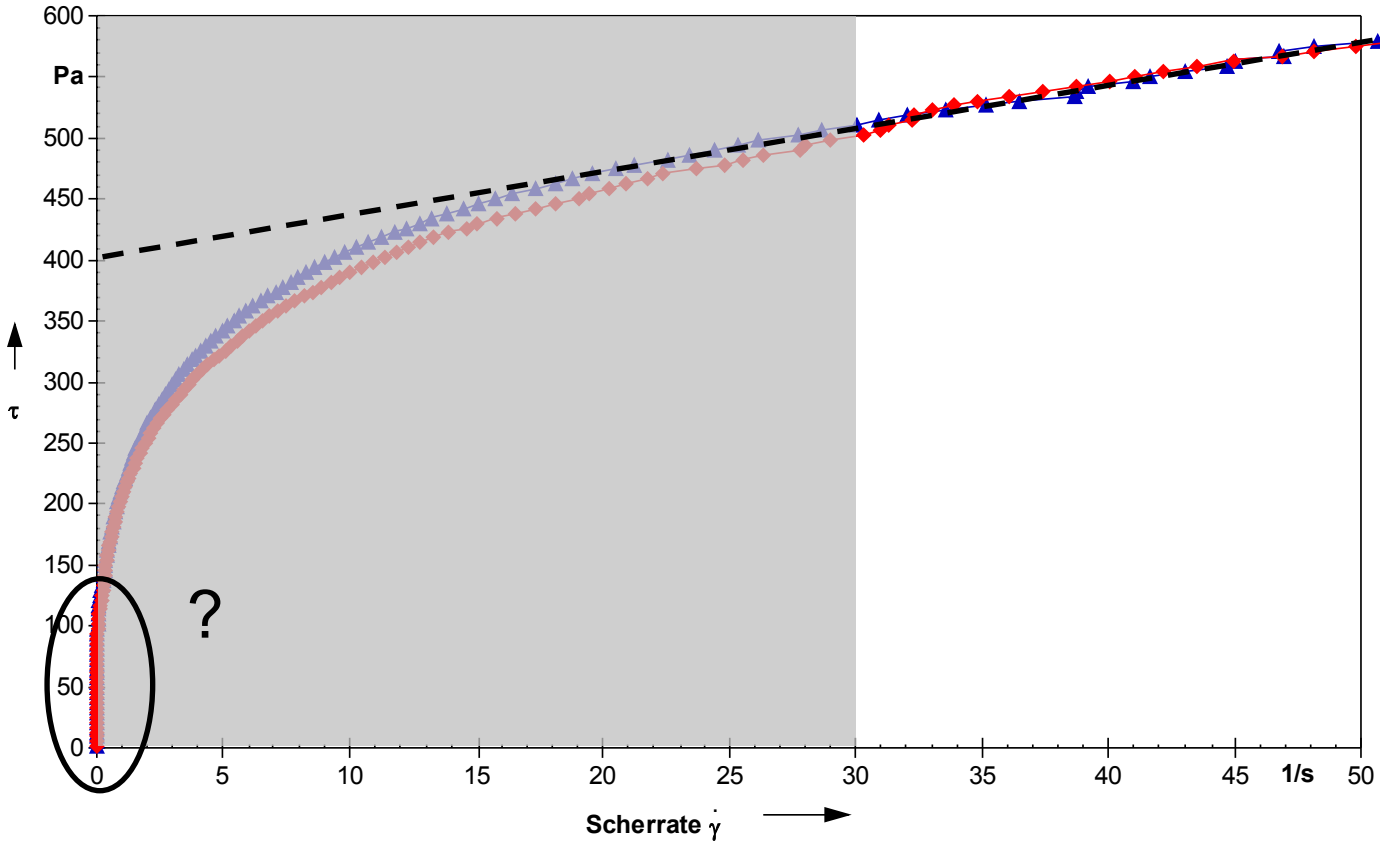
Part: I

Messsystem: CC27 (Dcc = 1,0847); profiliert
Temperatur: 23°C
Modus: CSS 1 - 1000 Pa, dgamma/dt < 50/s

estimation of working properties in complete shearing



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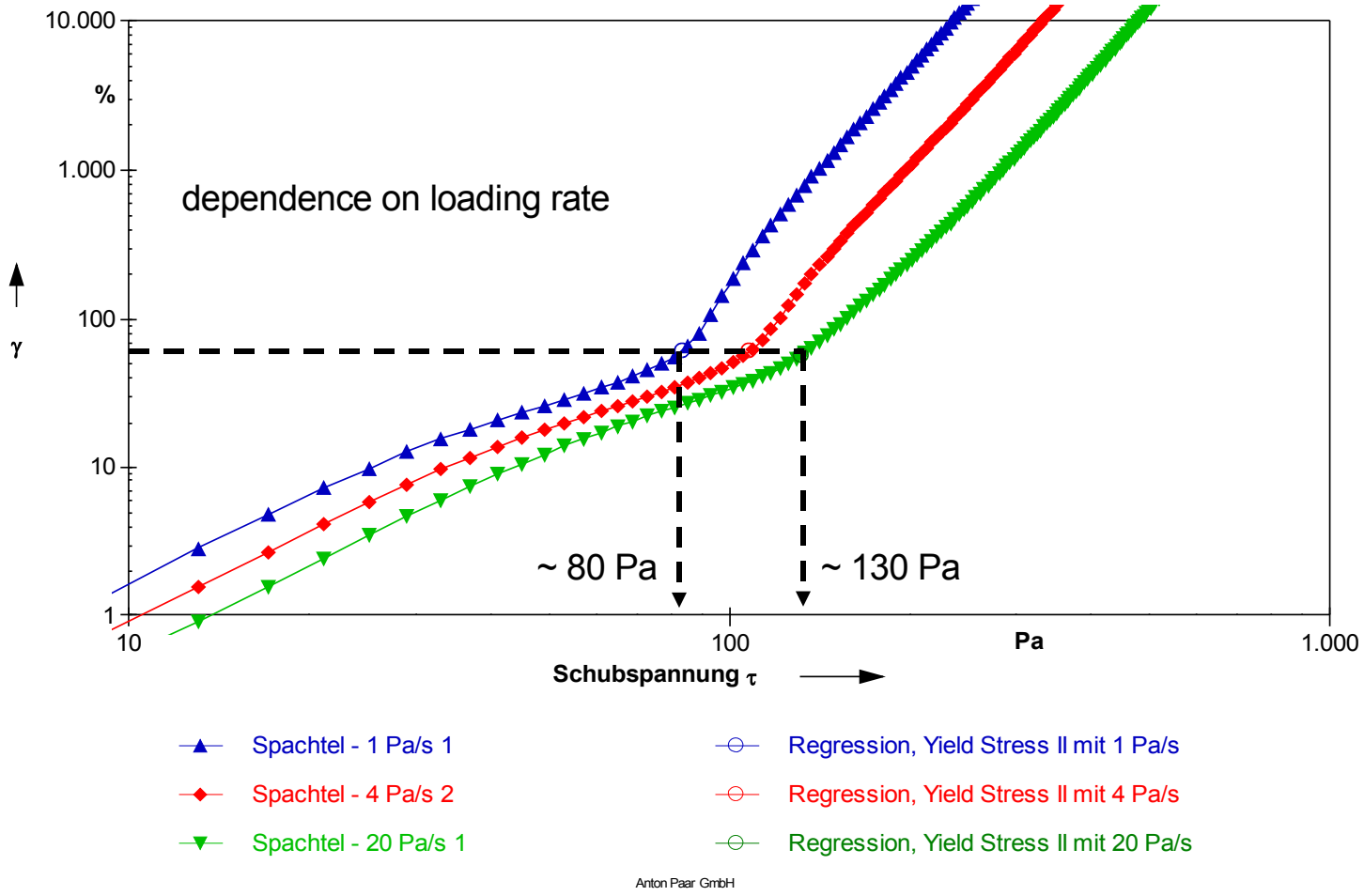

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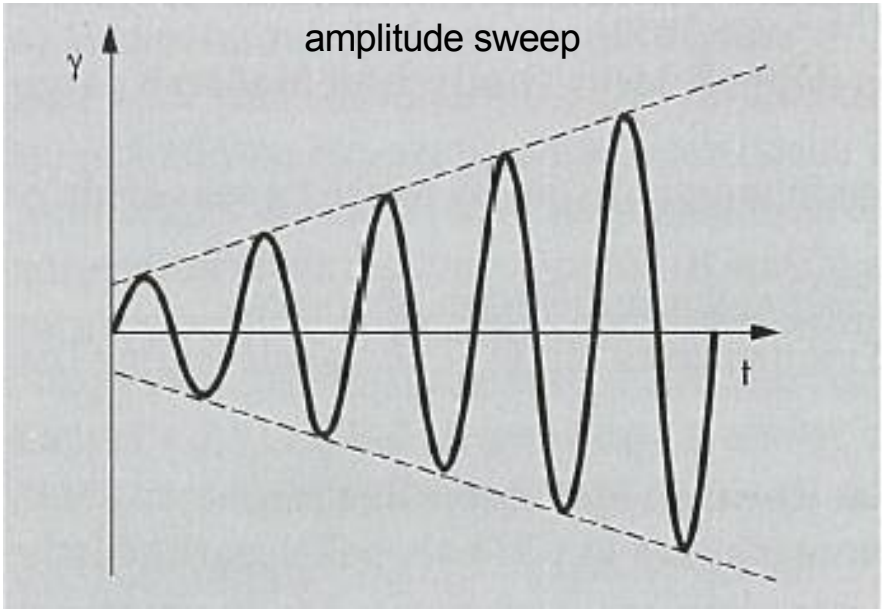
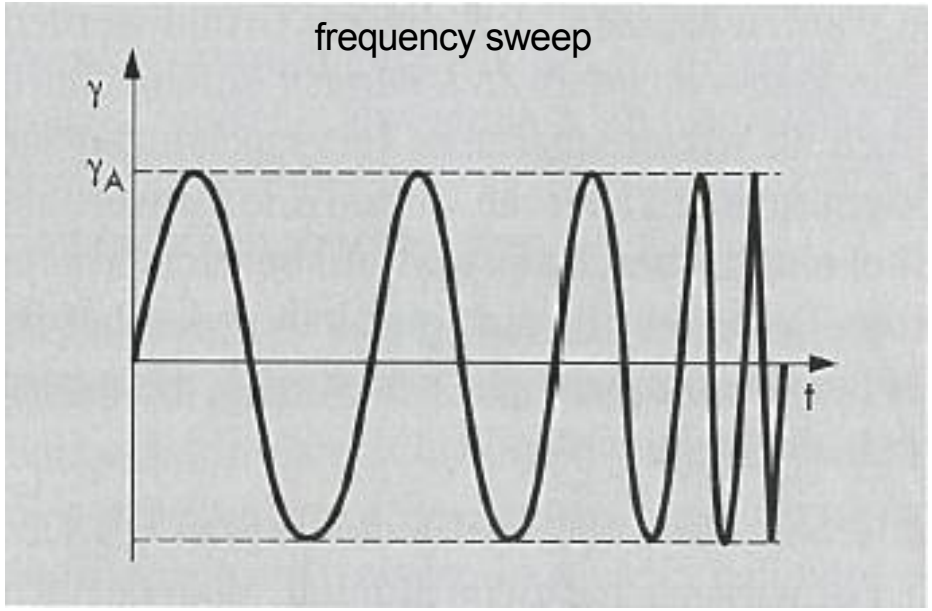
Material parameters on rheological studies of plasters and joint compounds

Part: II





(T.G. Mezger, Das Rheologie Handbuch, 2. Auflage)

controlled shear strain test	angular displacement (deformation)	→	torque (shear stress) phase shift / loss factor
controlled shear stress test	torque (shear stress)	→	angular displacement (deformation) phase shift / loss factor

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Part: II

viscoelastic

elastic

viscous

viscoelastic solid

phase shift angle < 45°

viscoelastic liquid

phase shift angle > 45°

Hooke's law:

$$\tau = G \cdot \gamma$$

➔ phase shift angle δ: 0°

Newton's law:

$$\tau = \eta \cdot \dot{\gamma}$$

➔ phase shift angle δ : 90°

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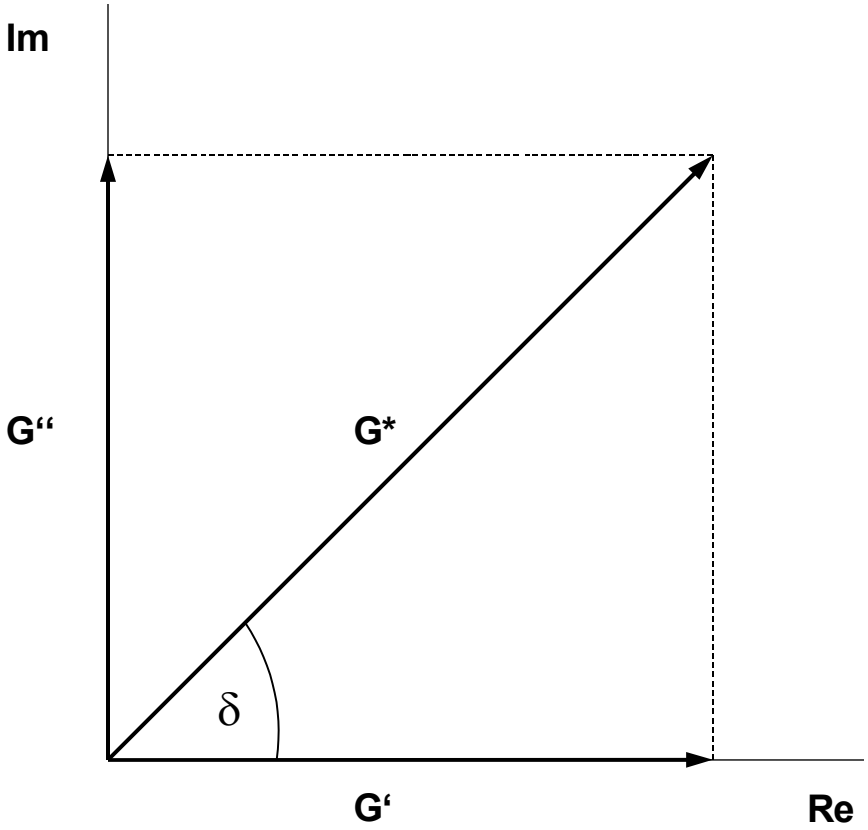
Material parameters on rheological studies of plasters and joint compounds

Part: II



G*	complex modulus
δ	phase shift angle
G‘	storage modulus
G‘‘	loss modulus

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Material parameters on rheological studies of plasters and joint compounds

Part: III

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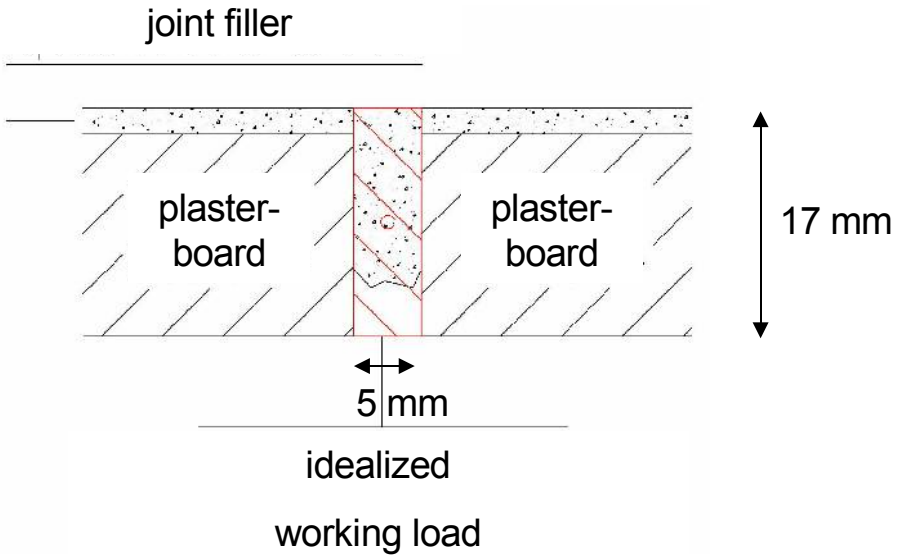
Material parameters on rheological studies of plasters and joint compounds

Part: III



rough calculation of loading

bulk density of joint filler: approx. 1.600 g/l
used volume: 1.7 x 0.5 x L cm (L = 1 cm/cm)
dead load: 1,600*(1.7*0.5*L) ≈ 14 N

expected stress: ≈ 30 Pa

description of self loading deformation

-delayed deformation combined with accelerated movement inside the joint
- formation of a droplet in load direction
- cessation of deformation/flow by hardening

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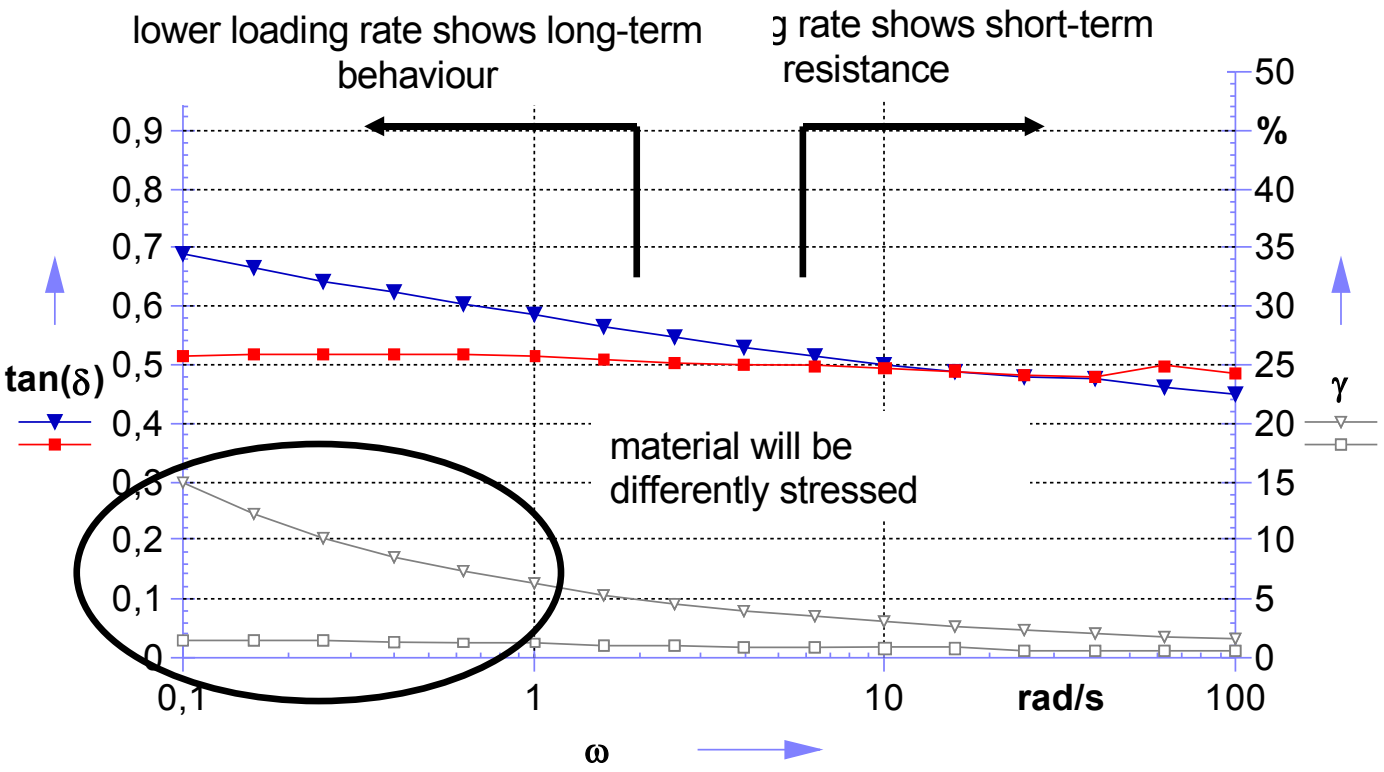
Part: III



Material parameters on rheological studies of plasters and joint compounds

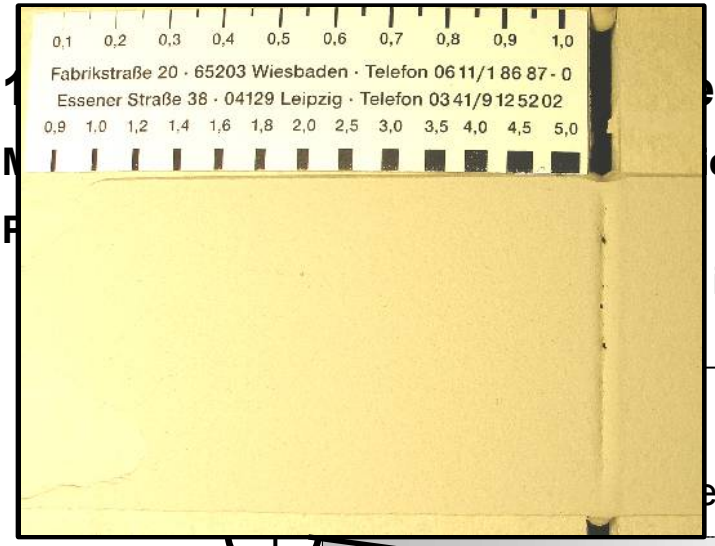
Part: III

standardization of different stresses in material by frequency-independent strain rate

$$\frac{d\gamma}{dt} = \frac{\Delta\gamma}{100} \bullet \frac{\Delta\omega}{2\pi}\left[s^{-1}\right]$$

direct comparison of tested material by "relative Beobachtungszeit (relative observation time) $t_{relativ}$"

$$t_{relativ} = 1/(\frac{d\gamma}{dt} \bullet 60)\left[\min\right]$$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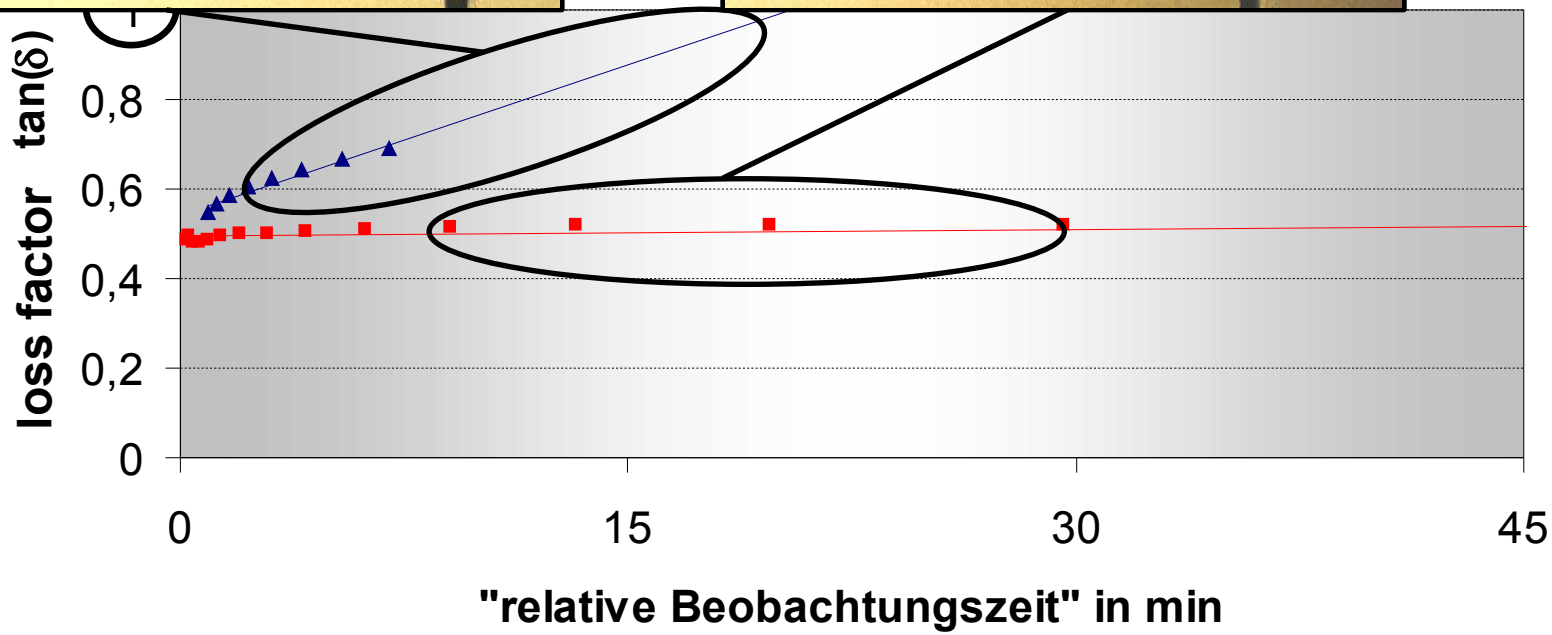
loss factor tan(δ)
0,8
0,6
0,4
0,2
0
0
15
30
45
"relative Beobachtungszeit" in min
filler with additive 1
filler with additive 2