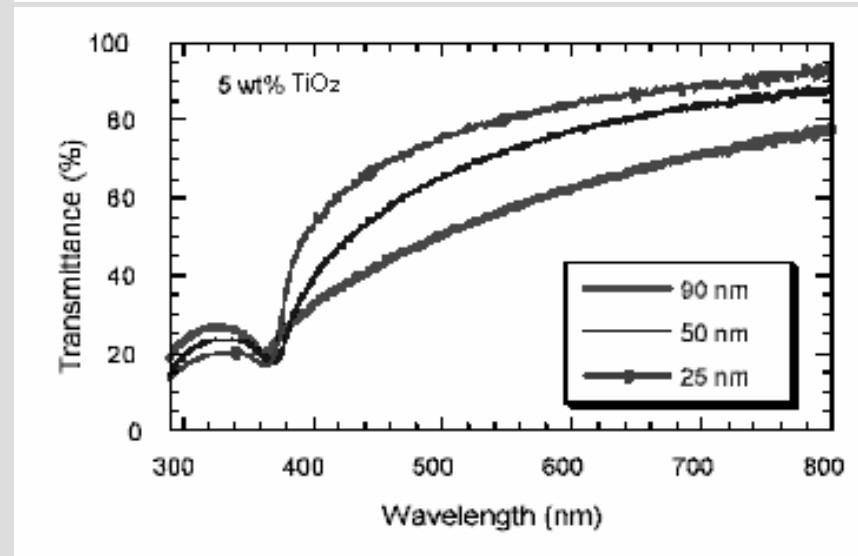
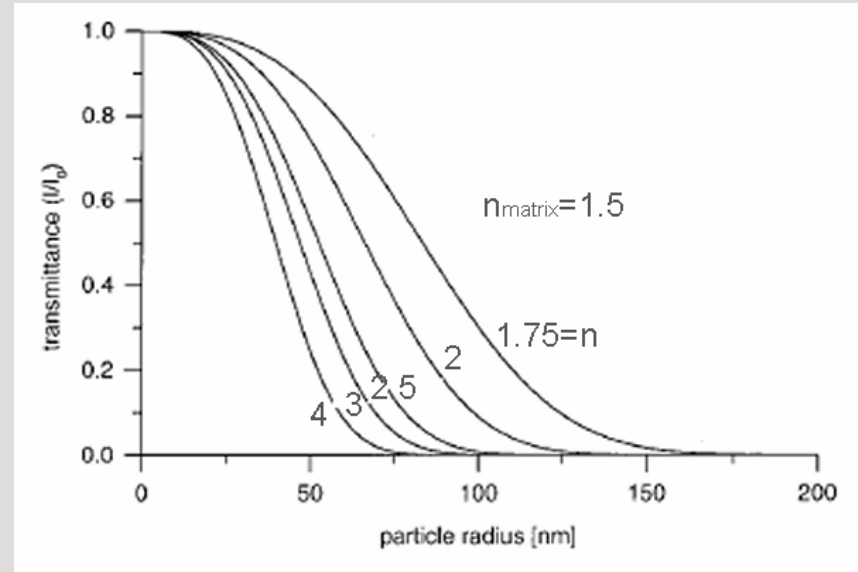
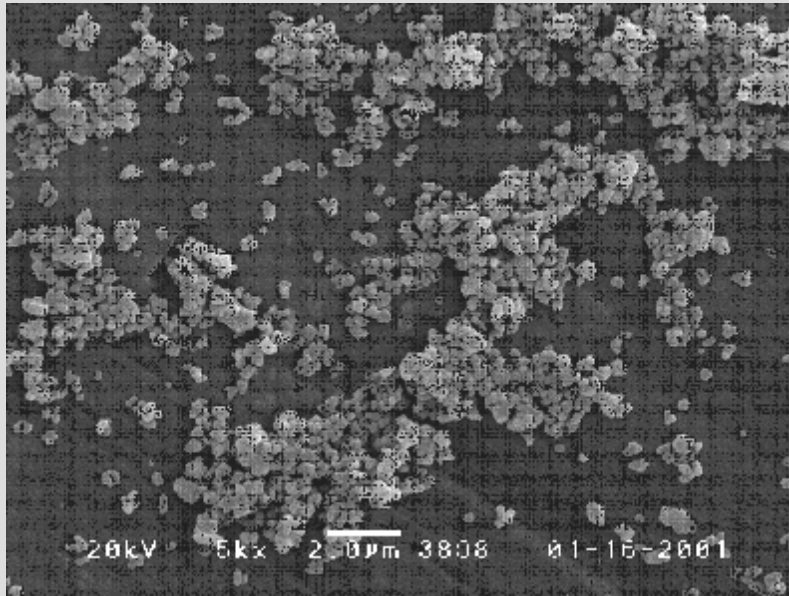


# Änderung der optischen Eigenschaften von Kunststoffen mit Nanopartikeln

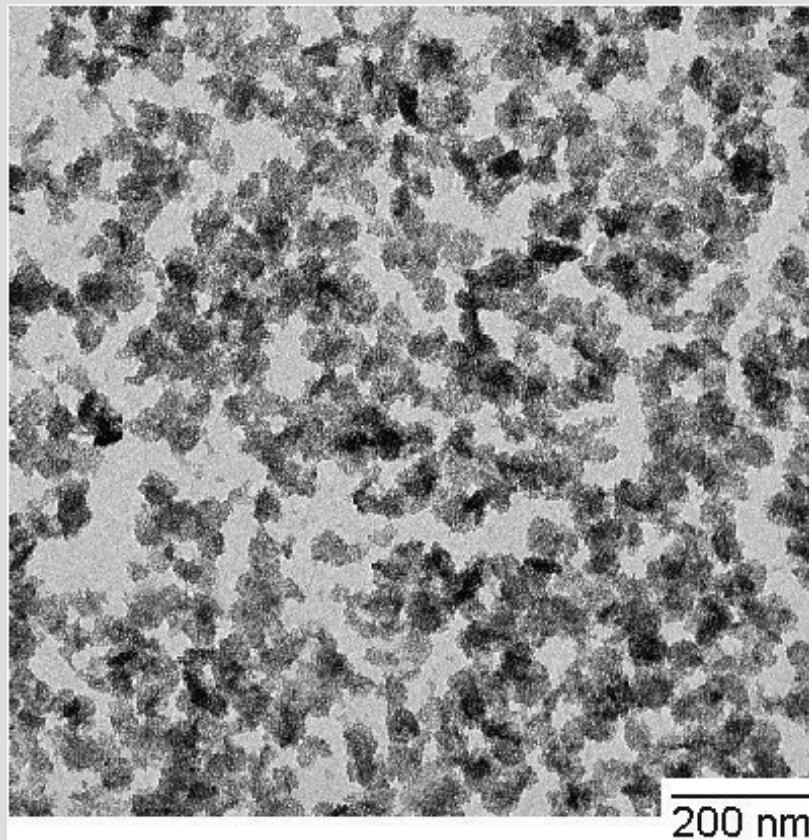


***GP Hellmann***

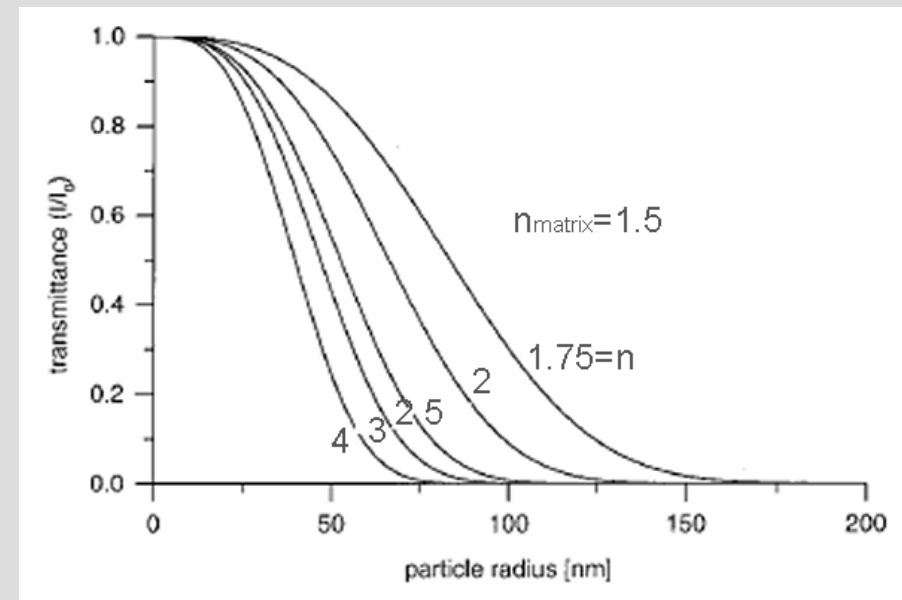
***regular TiO<sub>2</sub>:***  
**brilliant white pigment**  
**UV barrier**



anatas: particles 30-60nm

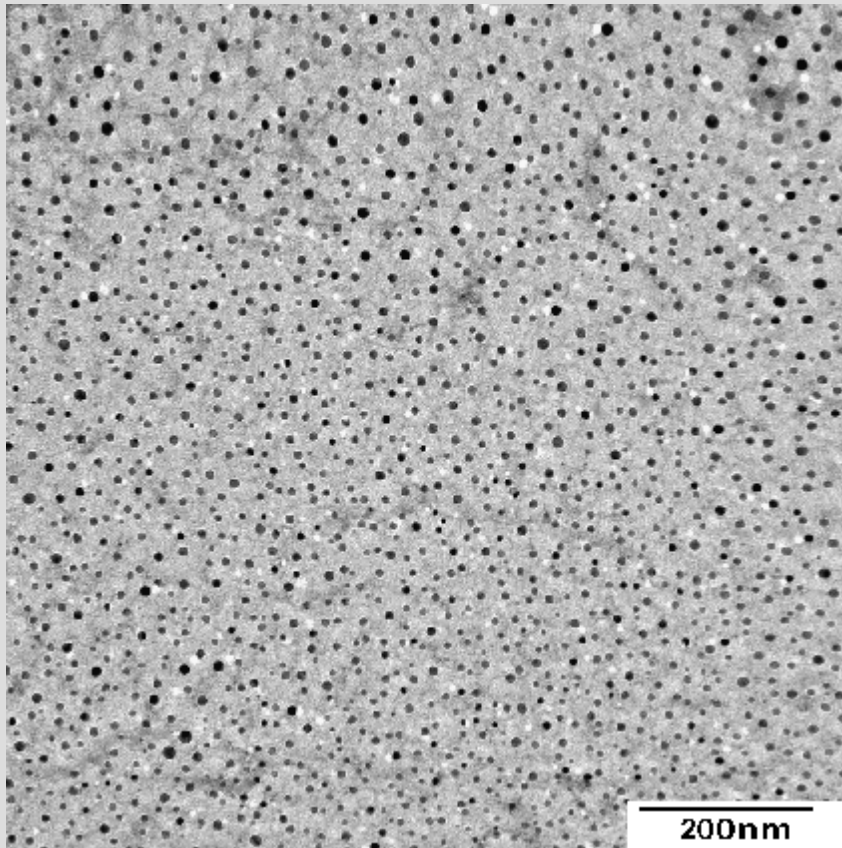


## Millennium Chemicals

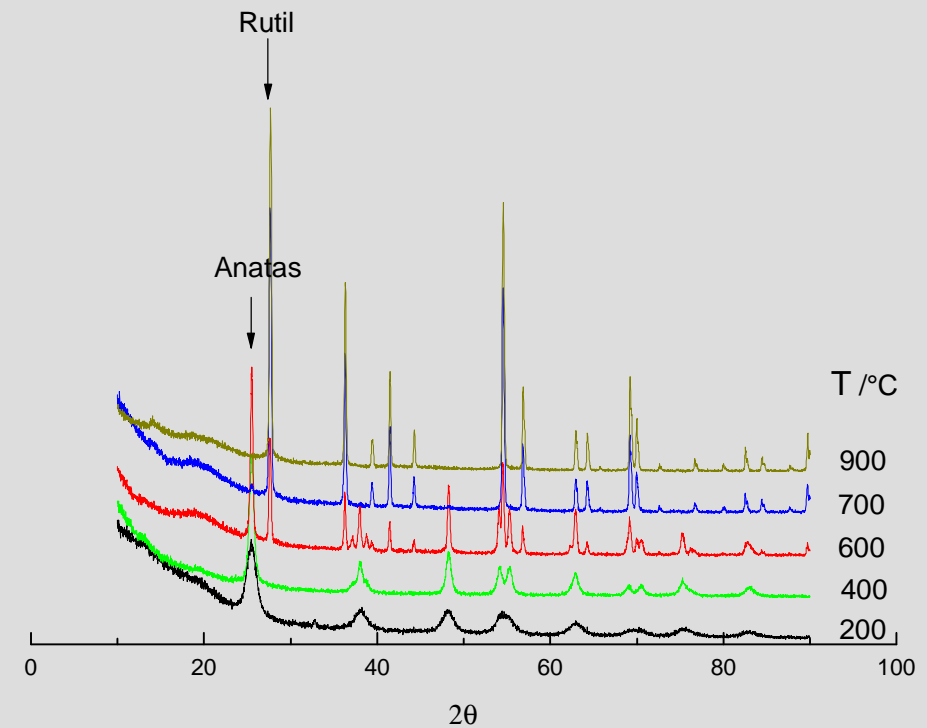


too big particles  
and all aggregations  
**kill transparency**

## nano TiO<sub>2</sub> particles 4-13nm



*high temperatures:*  
® anatas and rutil



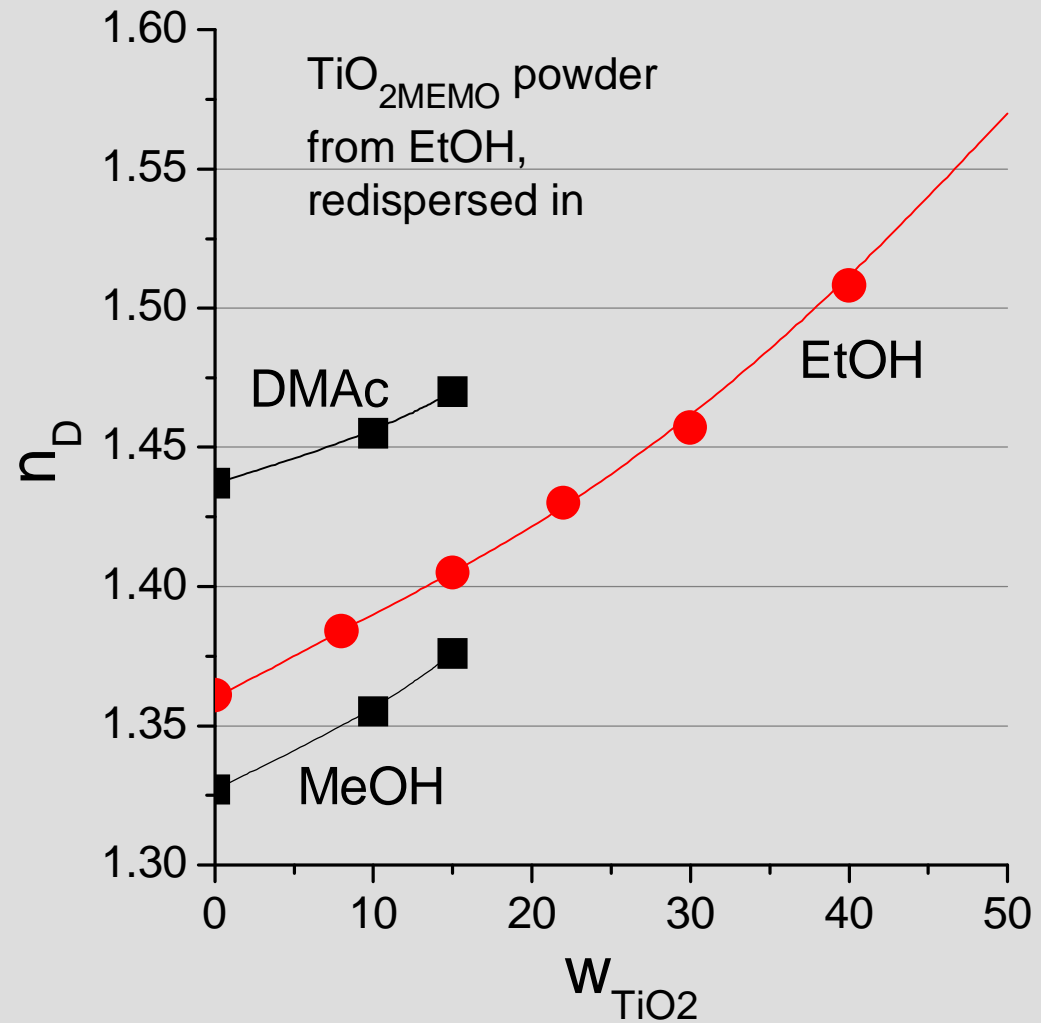
$$n_{\text{TiO}_2} = 2.5$$

$$r_{\text{TiO}_2} = 3.5$$

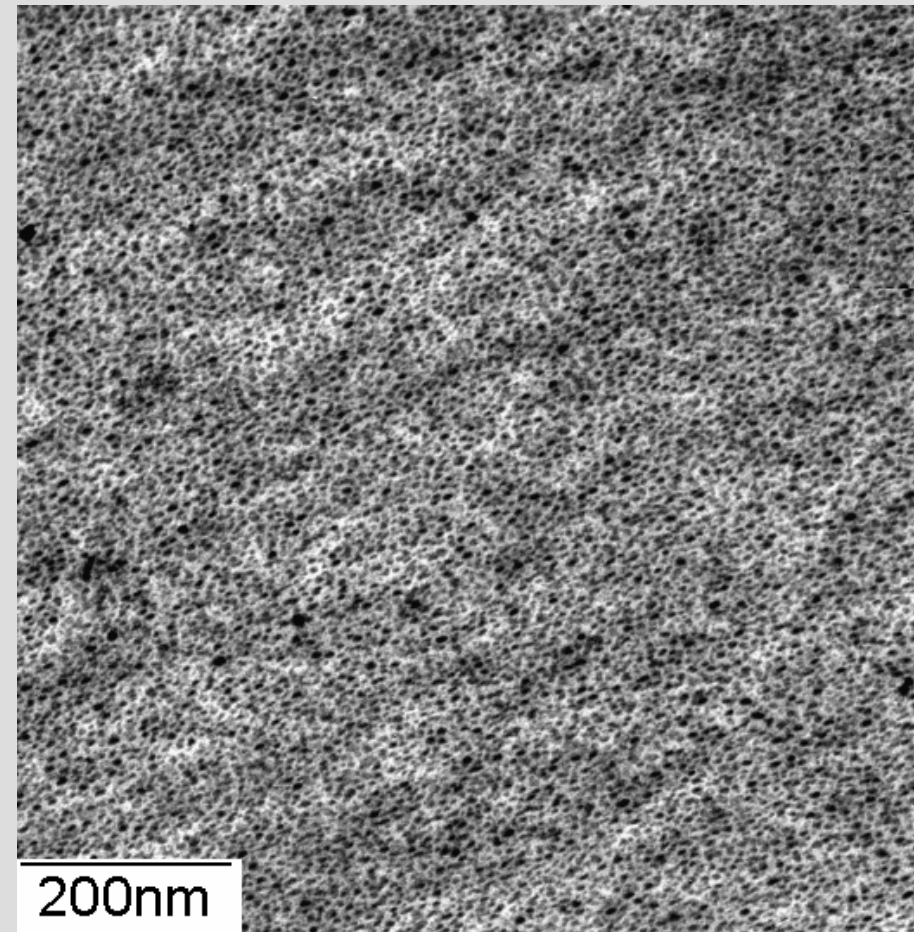
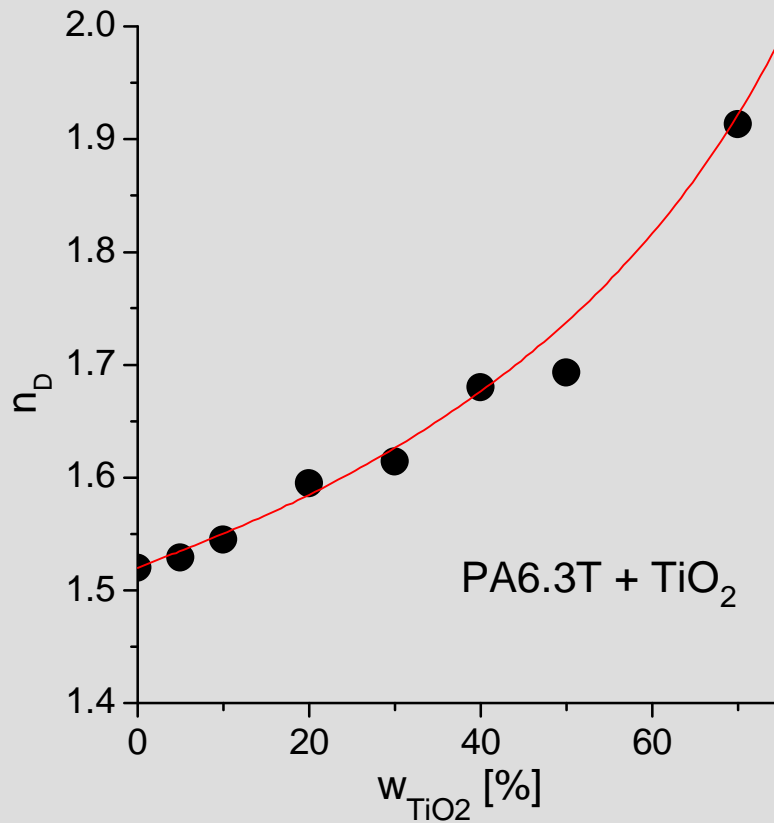
$$w_{\text{corrTGA}}$$

$$n = f n_{\text{TiO}_2} + (1 - f) n_{\text{solv}}$$

$$\frac{1}{f} = 1 + \frac{r_{\text{TiO}_2}}{r_{\text{solv}}} \frac{1 - w}{w}$$



PA6.3T +30wt% TiO<sub>2</sub><sub>MEMO</sub>



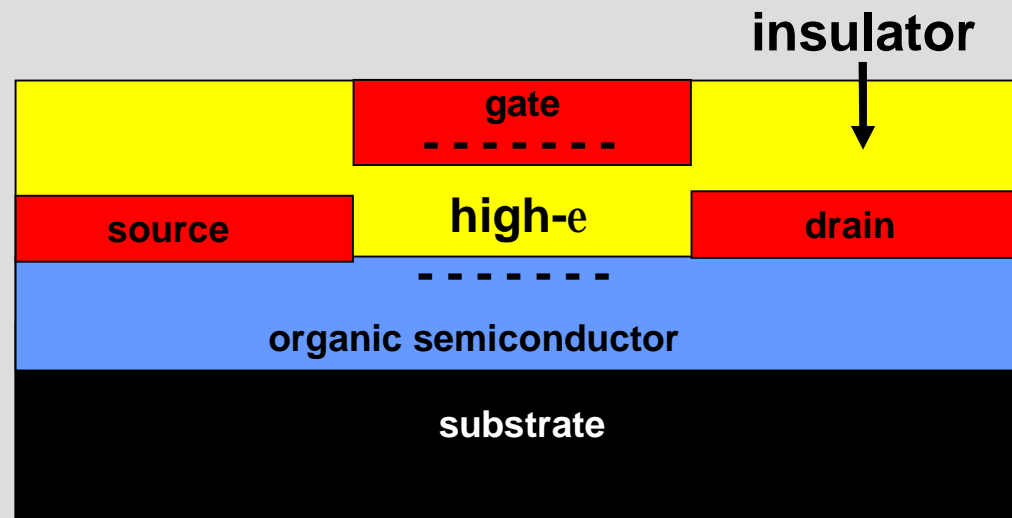
**PMMA**  
**+ 30wt% TiO<sub>2</sub>**

100nm thick  
transparent

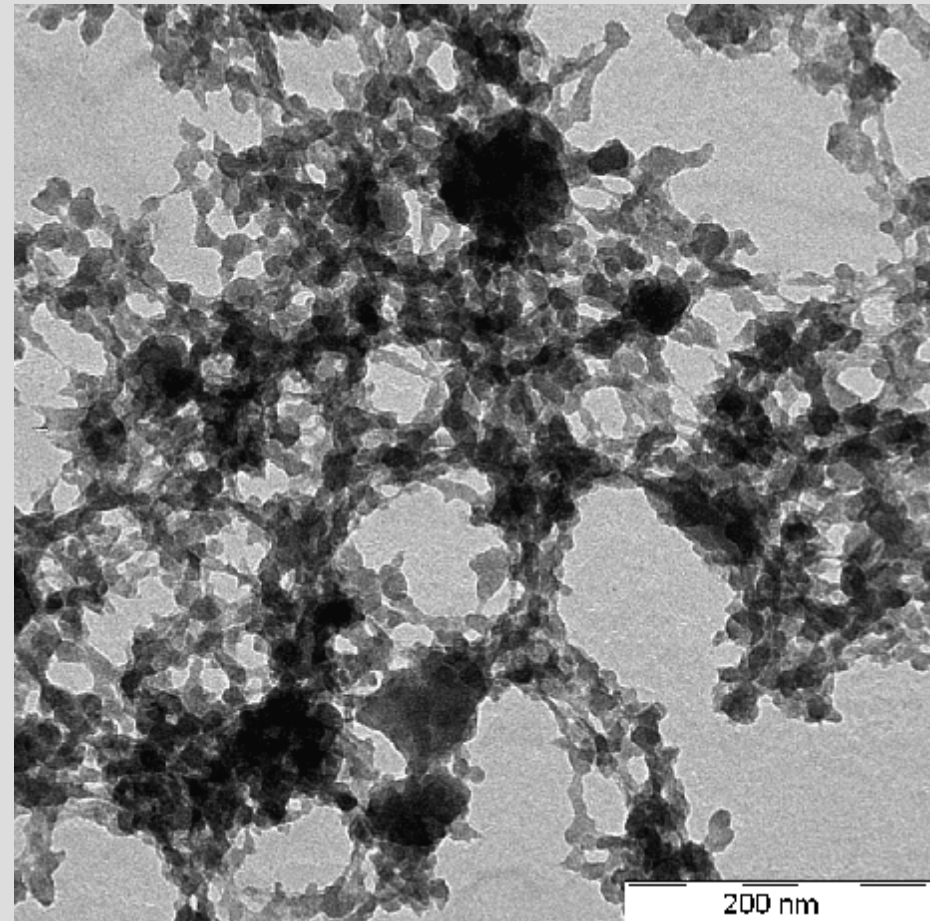
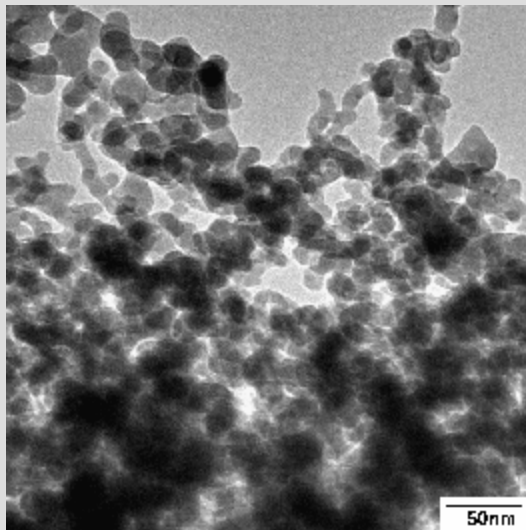
**n = 1.59**  
**e = 3.9**

gate insulator:  
*low conductivity*  
*high dielectric constant*

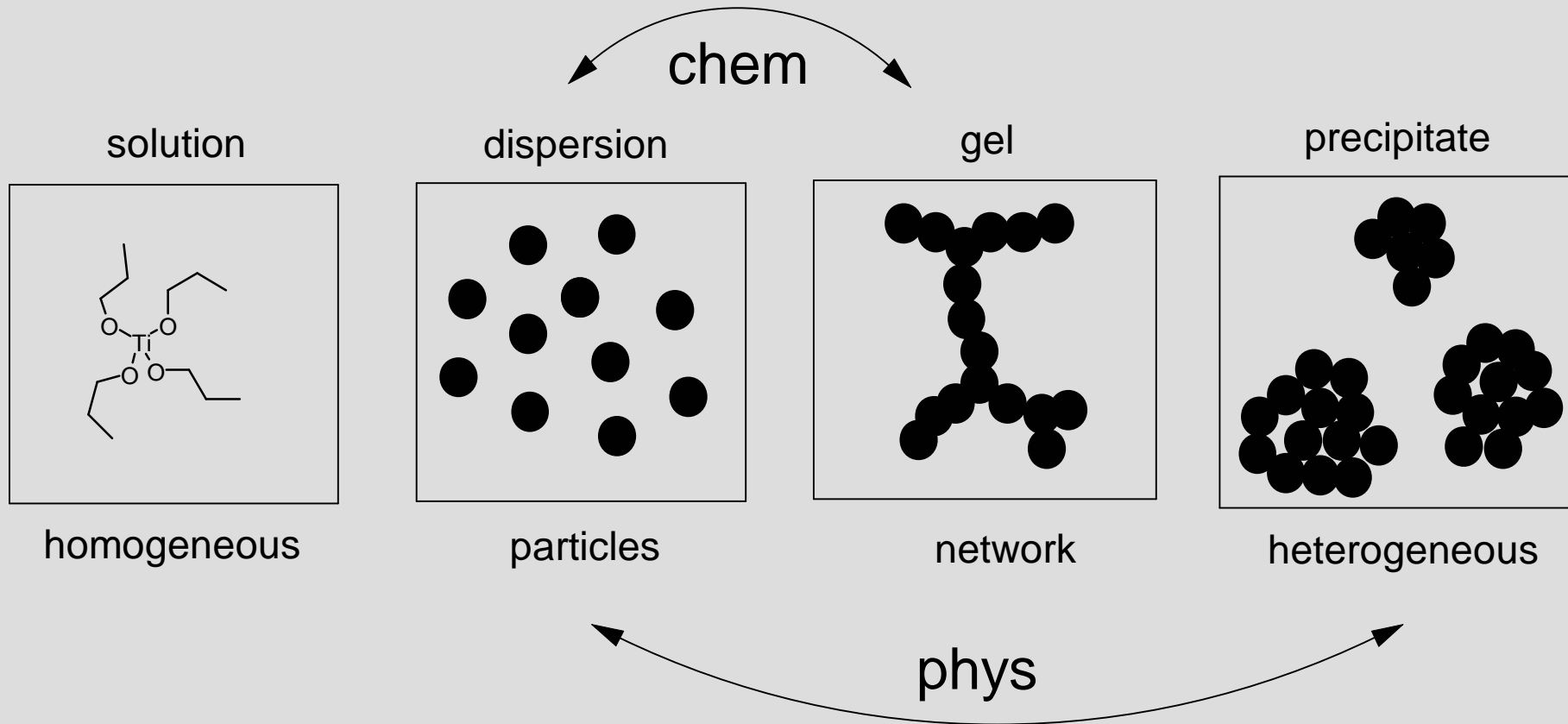
high-e spin-coated layers for OFETs  
Prof von Seggern, Dr Schmechel, TUD-MW



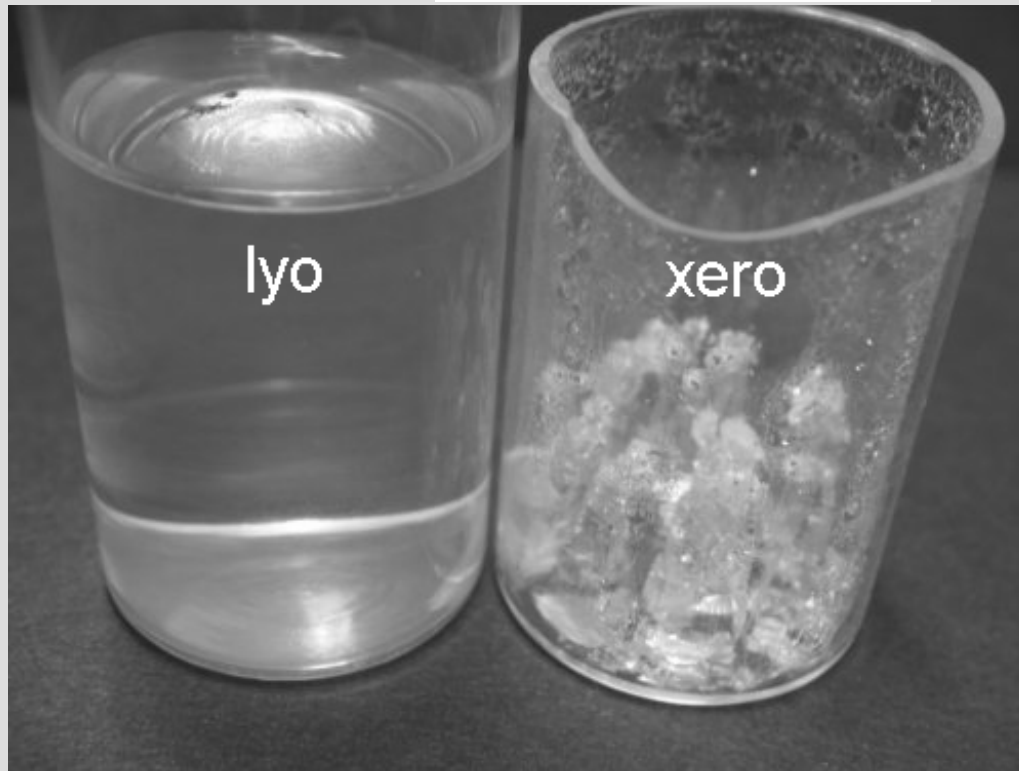
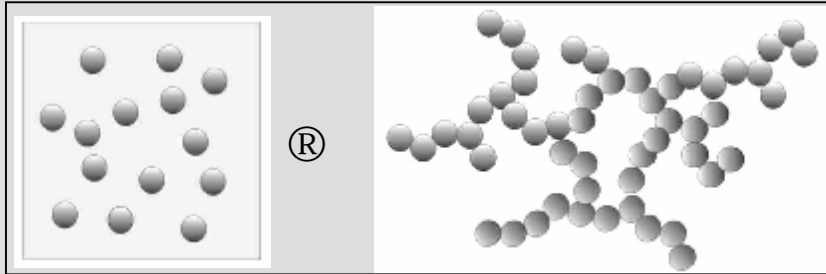
*shear at high  
temperatures:*  
**aggregation**



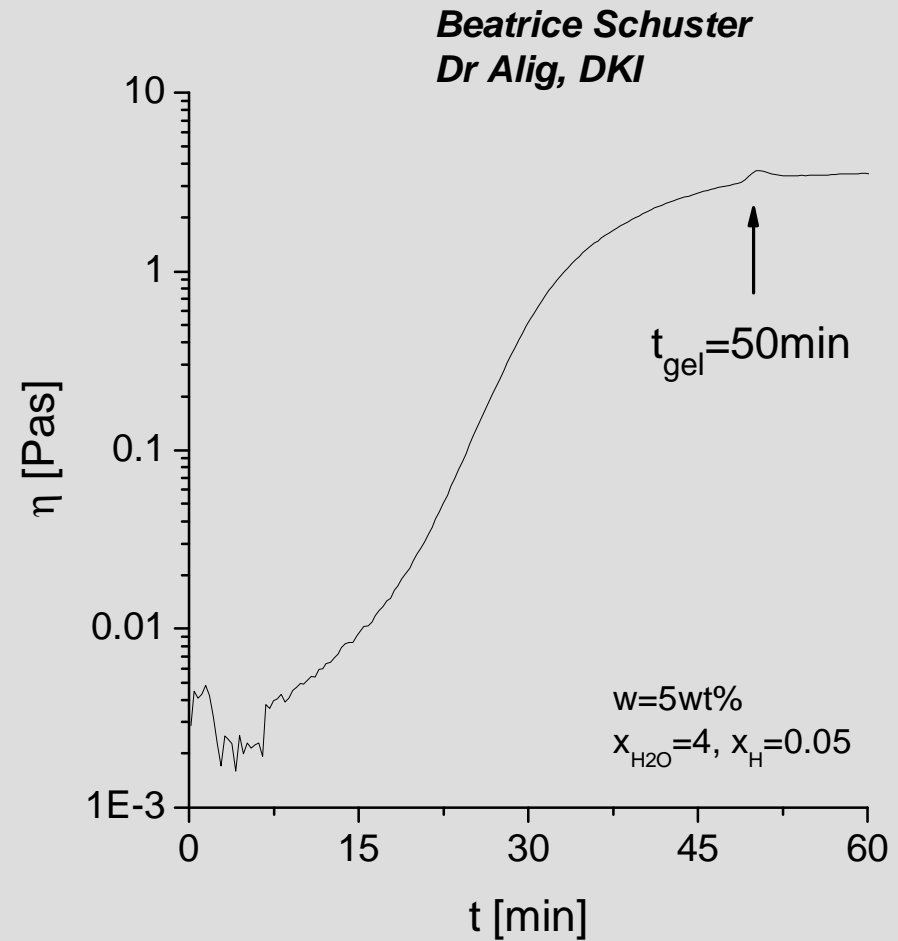
*enemies:*  
**gels and aggregates**



# Gels: Lyo and Xero



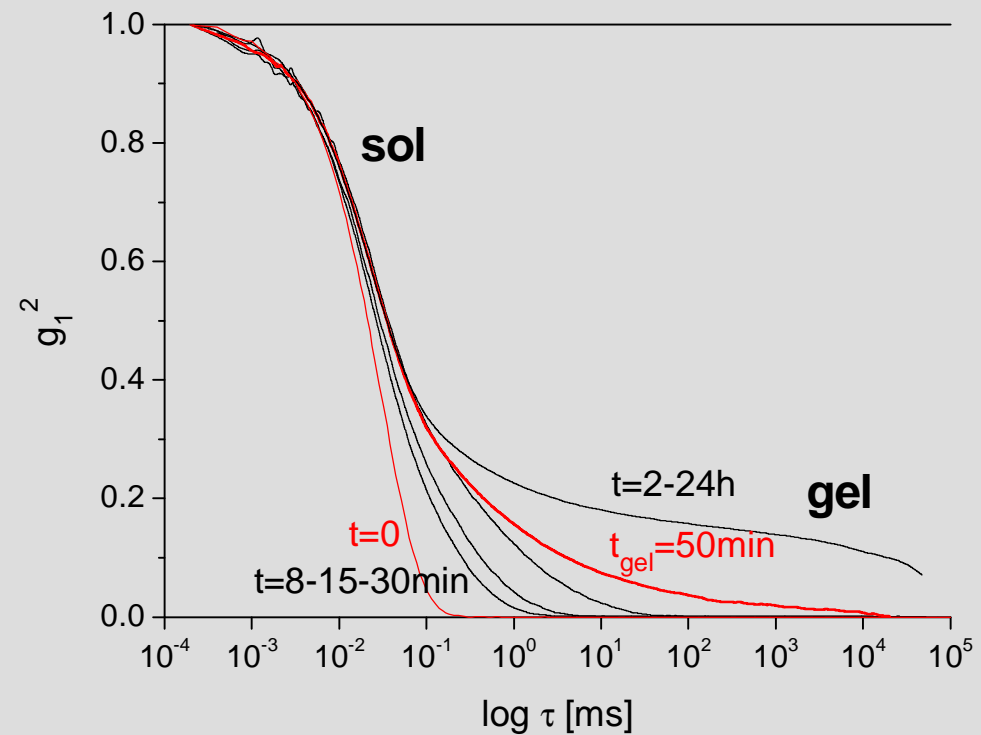
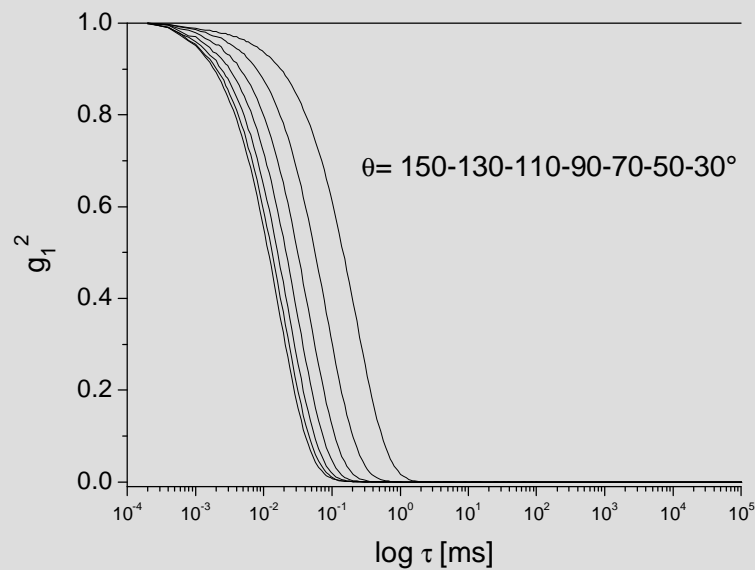
*dynamic Couette:*  
early detection of clusters



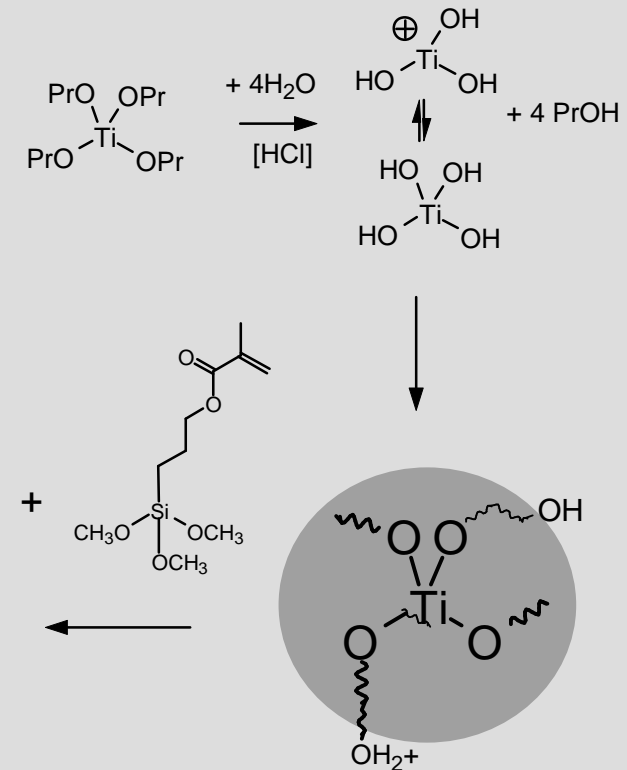
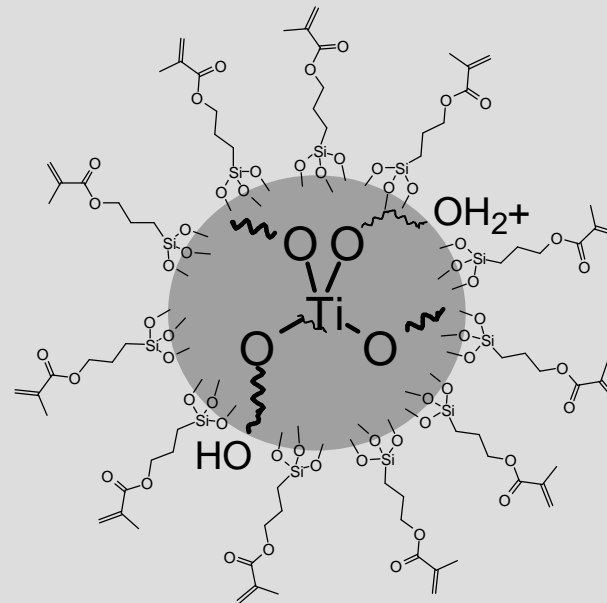
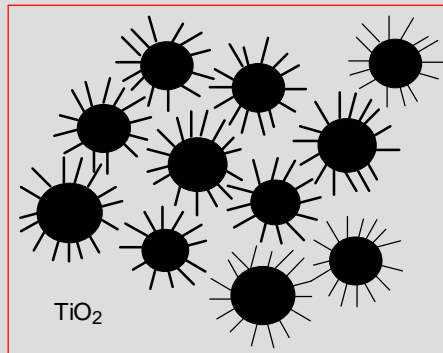
$$\langle r_q(t=0)r_q(t) \rangle^2 = g_1^2 = \left[ \exp\left(-\frac{t}{\tau}\right) \right]^2$$

particles,  
converted into a gel

only particles, no gel

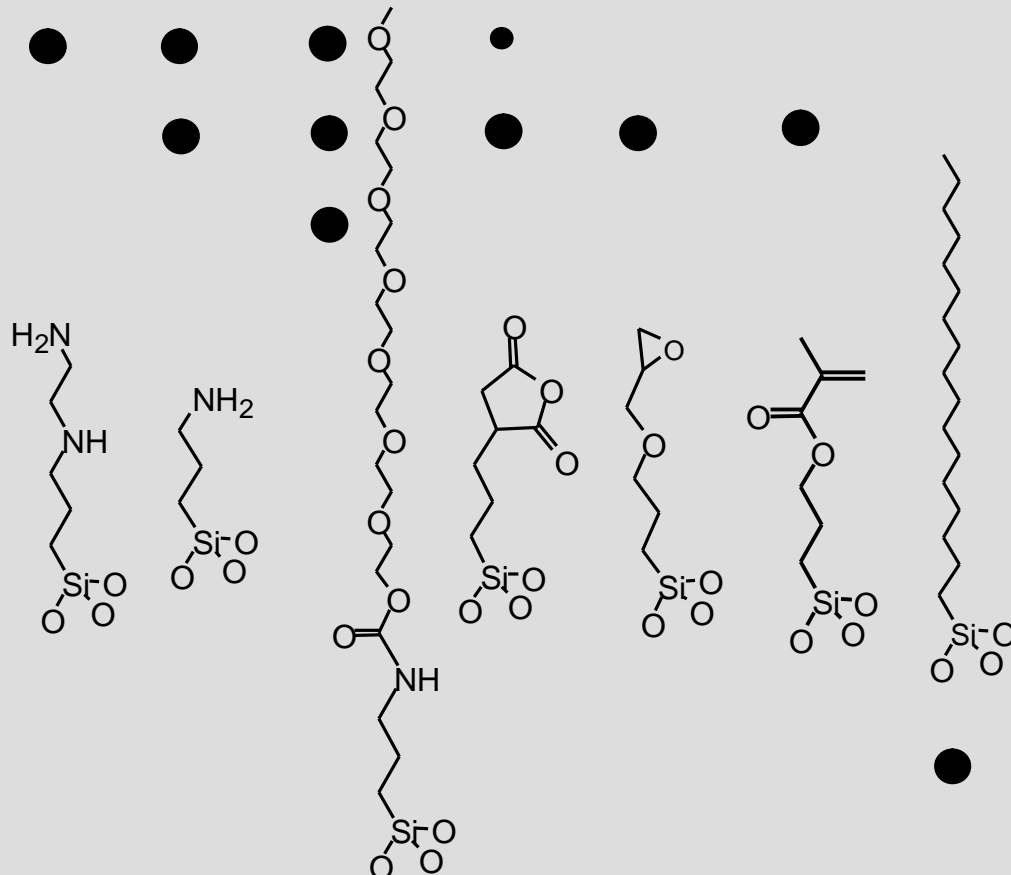


*polymer-TiO<sub>2</sub> hybrids must  
sustain extruder conditions*



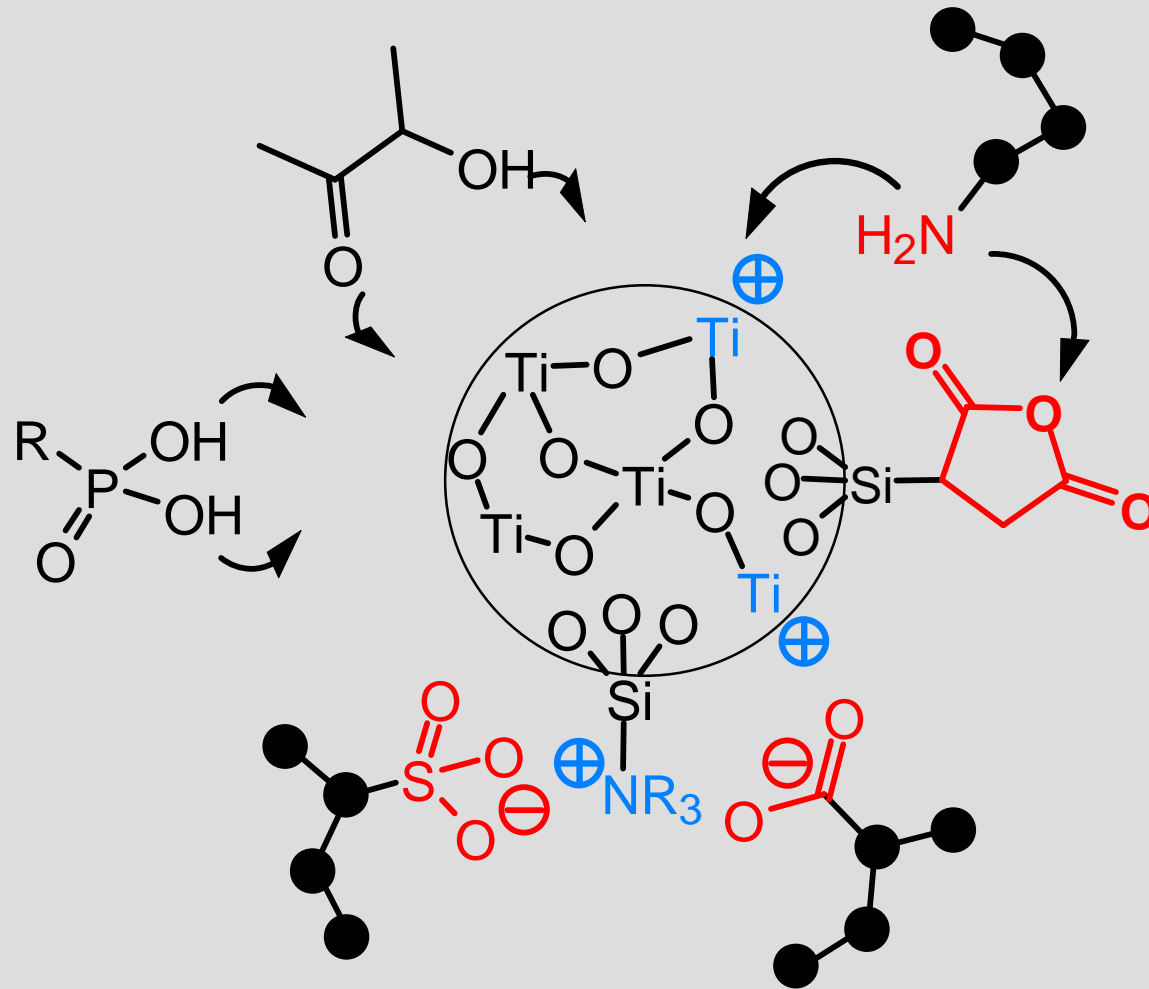
*solubility  
of modified  
TiO<sub>2</sub>*

H <sub>2</sub> O	●	●	●	●	●	●	●
EtOH		●	●	●	●	●	●
THF			●				
toluene							●

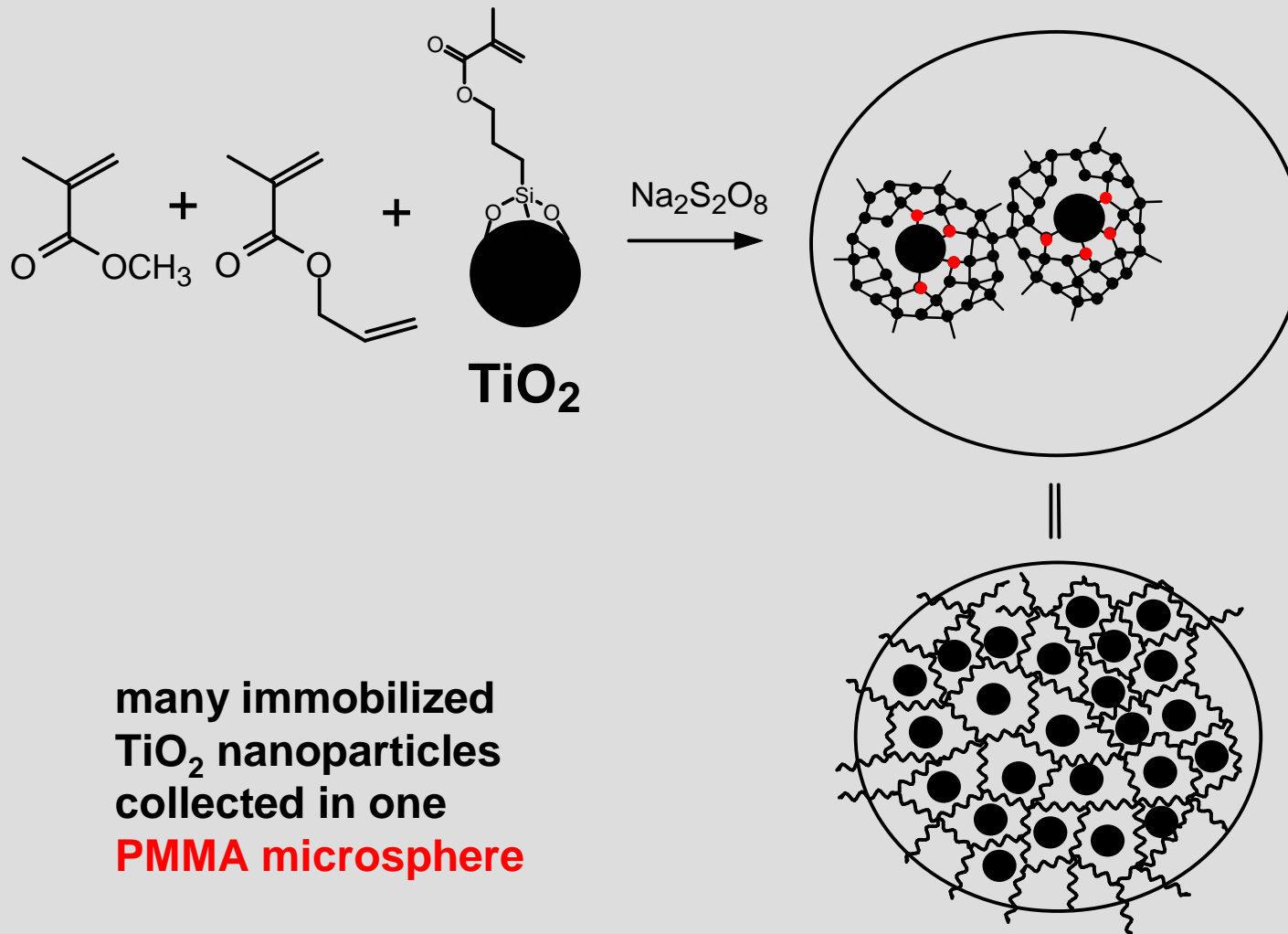
  


other  
 surface  
 stabilizers  
 for  
**TiO<sub>2</sub>**

*temperature  
 resistant?*

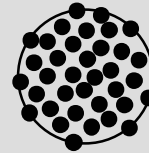
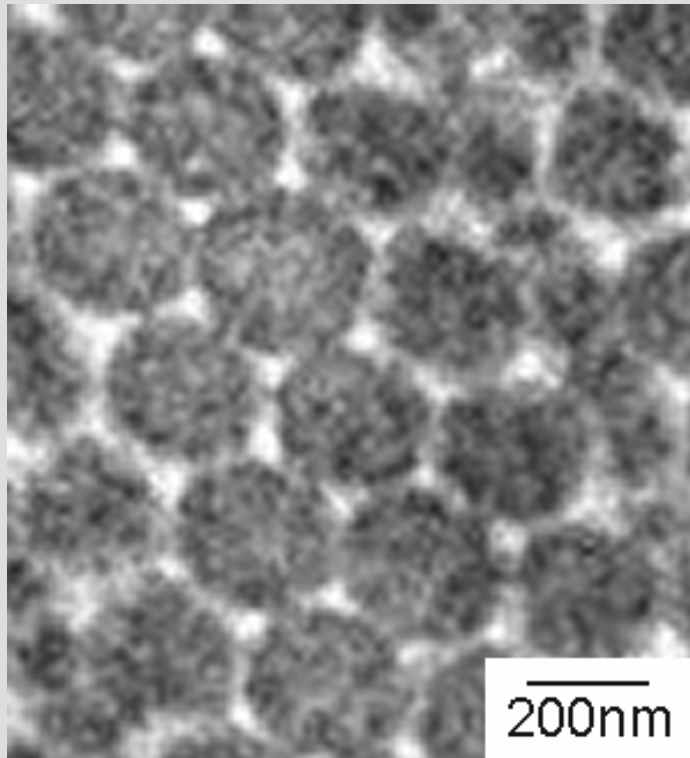


# Crosslink Protection in Polymer-TiO<sub>2</sub> Hybrids

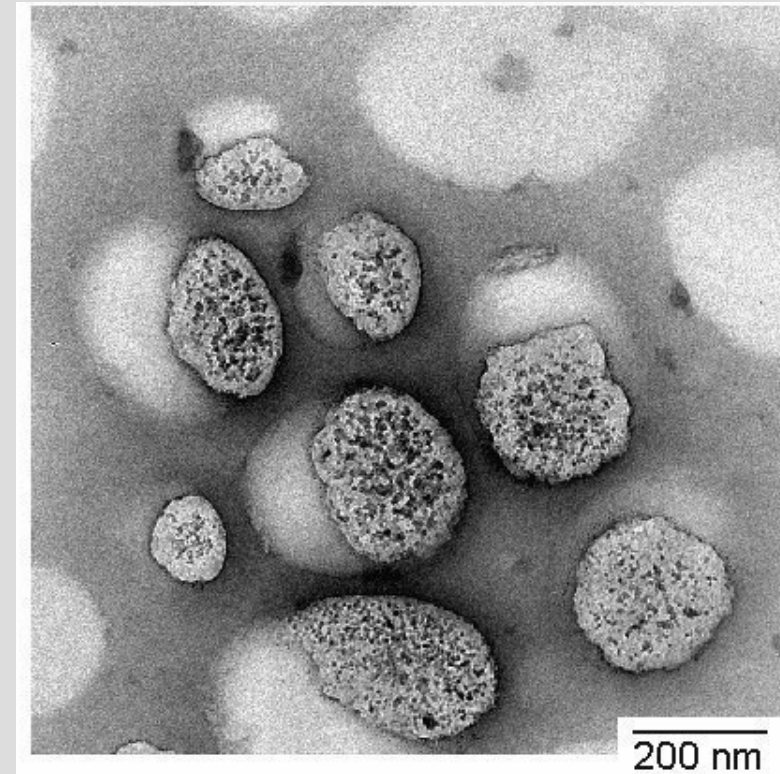


## hybrids PMMA-TiO<sub>2</sub>

from water



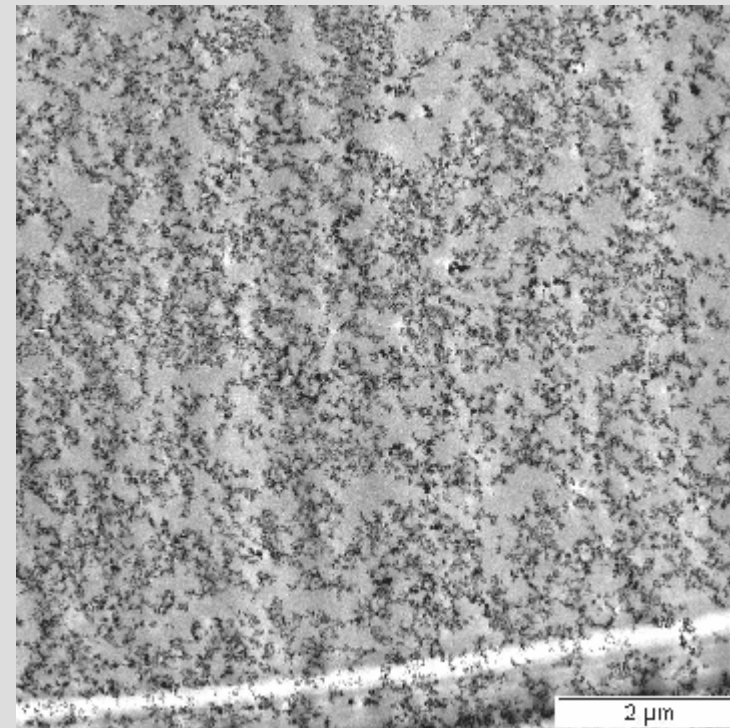
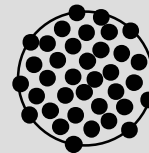
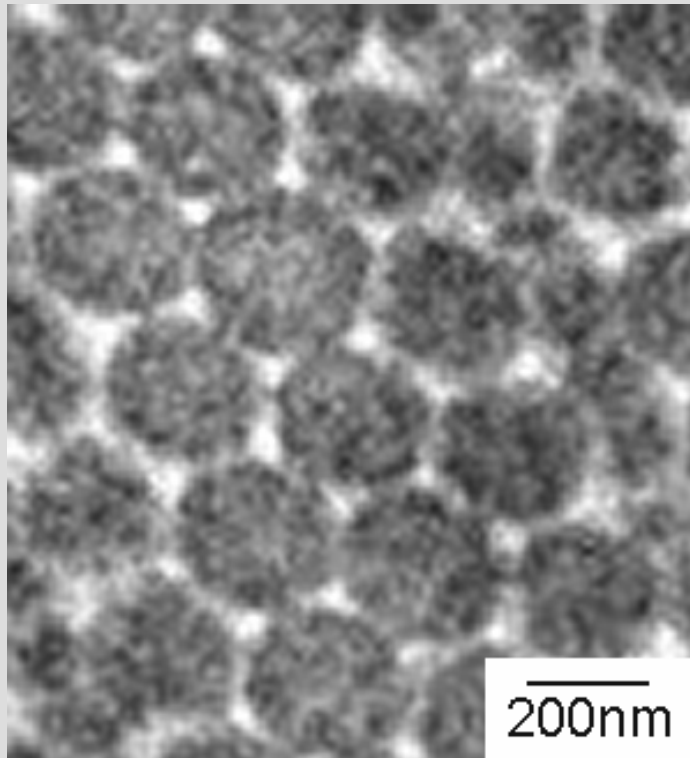
from MeOH



## hybrids PMMA-TiO<sub>2</sub>

from water

at 220°C



**extrusion  
injection molding**

