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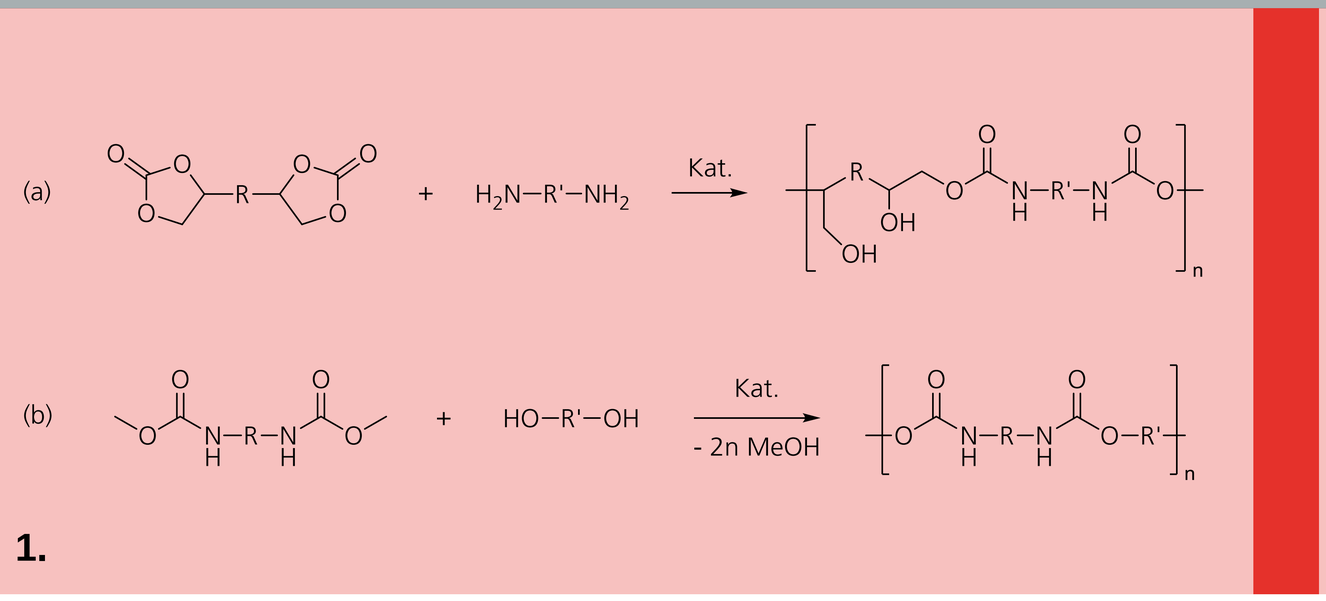
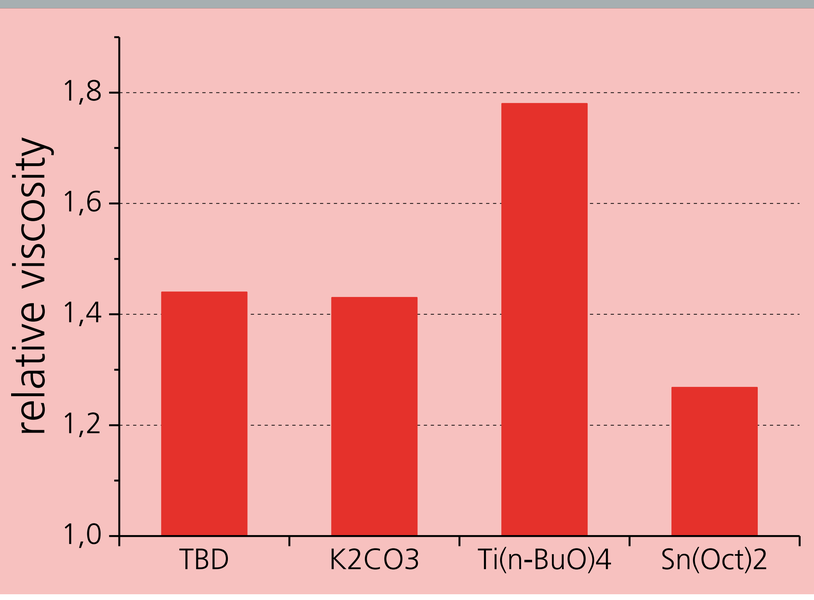
FRAUNHOFER INSTITUTE FOR APPLIED POLYMER RESEARCH IAP



1.



2.

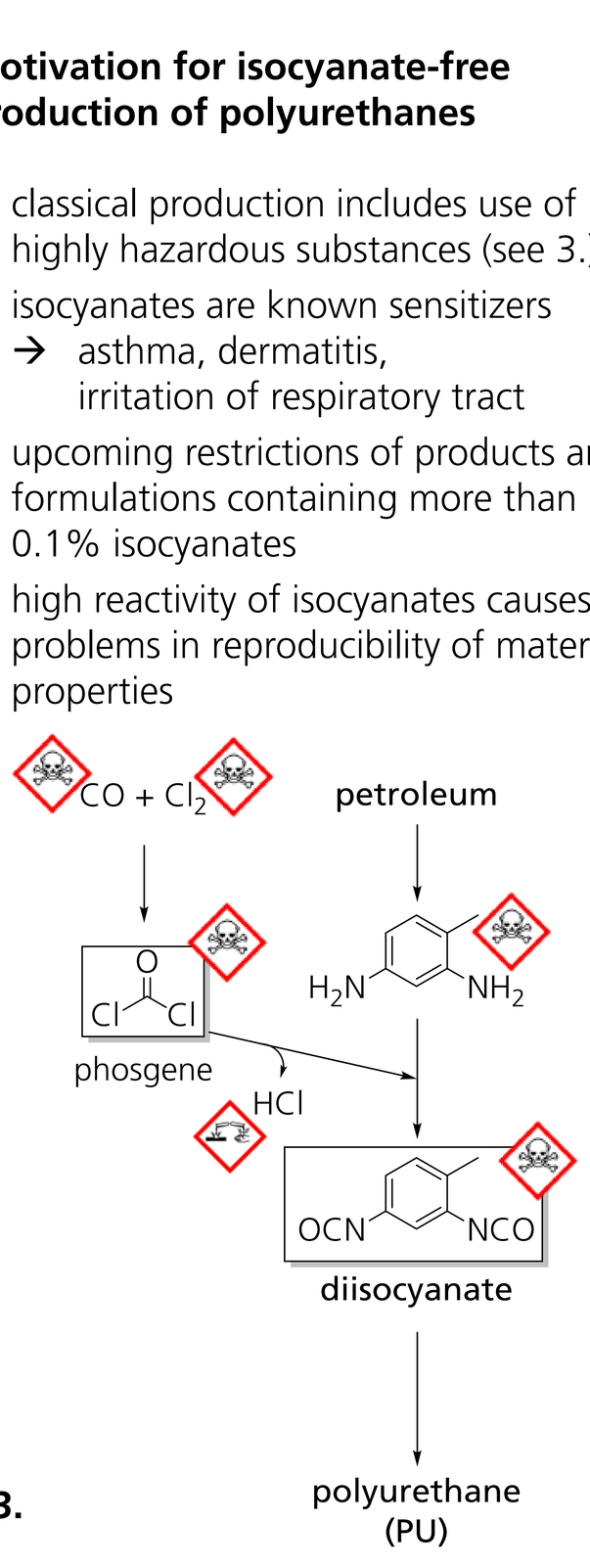
1. *Synthesis methods for non-isocyanate polyurethanes (NIPUs):*
   (a) Polyaddition of diamines and cyclic carbonates yielding poly(β-hydroxyurethanes).
   (b) Polycondensation of dicarbamates and diols yielding polyurethanes.
2. *Screening of catalysts for polycondensation of DMHC, PTHF and 1,4-butanediol*
3. *Classical production of polyurethanes using highly hazardous substances.*

ISOCYANATE-FREE POLYURETHANES – approaching industrial feasibility

NIPU-technology by Fraunhofer IAP

Motivation for isocyanate-free production of polyurethanes

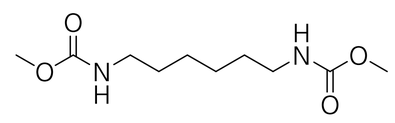
- classical production includes use of highly hazardous substances (see 3.)
- isocyanates are known sensitizers
  → asthma, dermatitis, irritation of respiratory tract
- upcoming restrictions of products and formulations containing more than 0.1% isocyanates
- high reactivity of isocyanates causes problems in reproducibility of material properties



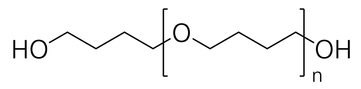
3.

NIPU process development and structure-property-relationships

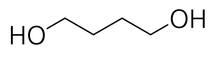
- screening of catalysts model system:



Dimethyl-1,6-hexamethylendicarbamat
DMHC



Poly(tetramethylenglycol)
PTHF



1,4-butanediol

- polycondensation process established: 7 h, 180 °C, vacuum, 1L reactor
- first tensile and Shore hardness tests show promising results:
  - Shore A 82
  - 360% elongation at break
  - E modulus 83 MPa
- structure-property-relationships:
  - ratio hard to soft segments
  - variation of diols
- expanding toolbox of building blocks
  - polyester/polycarbonate diols
  - aromatic dicarbamates (analogues of TDI, MDI)

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