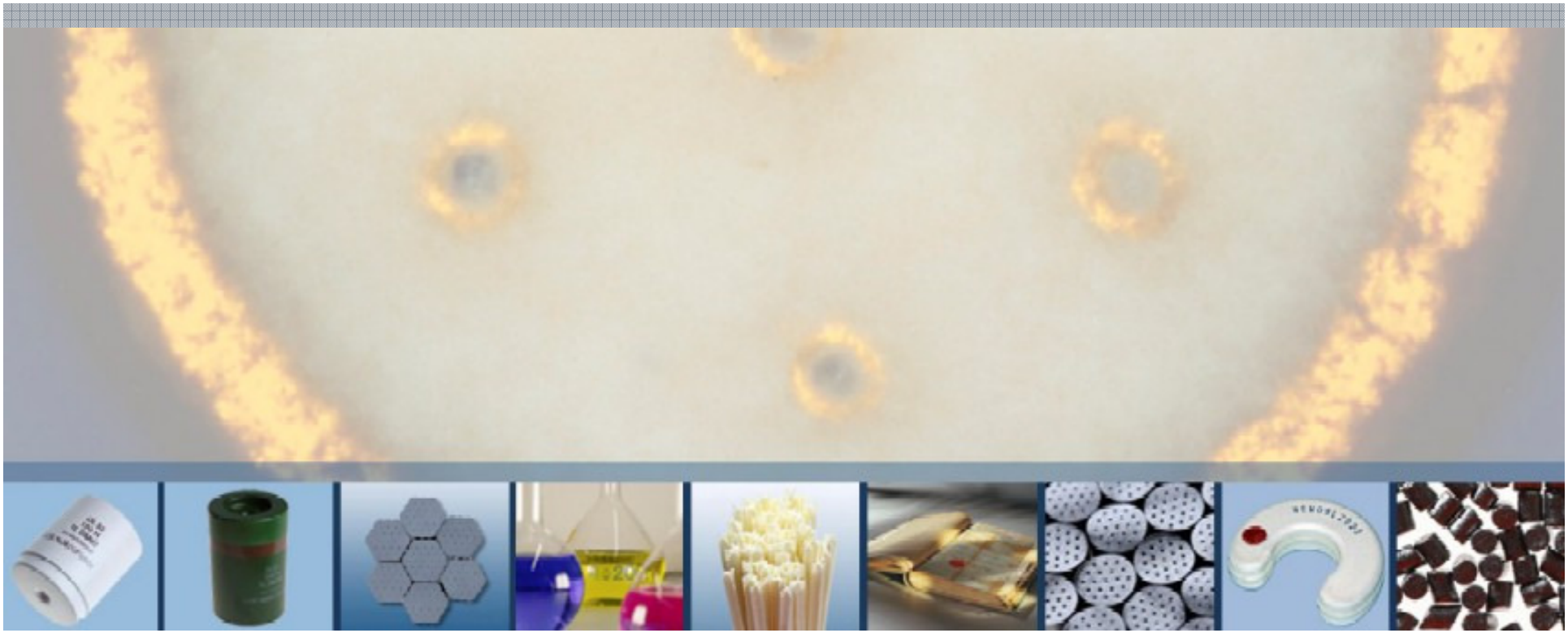


Nitrocellulose Degradation – an Important Factor to Assess Ageing / Stability of Gun Propellants

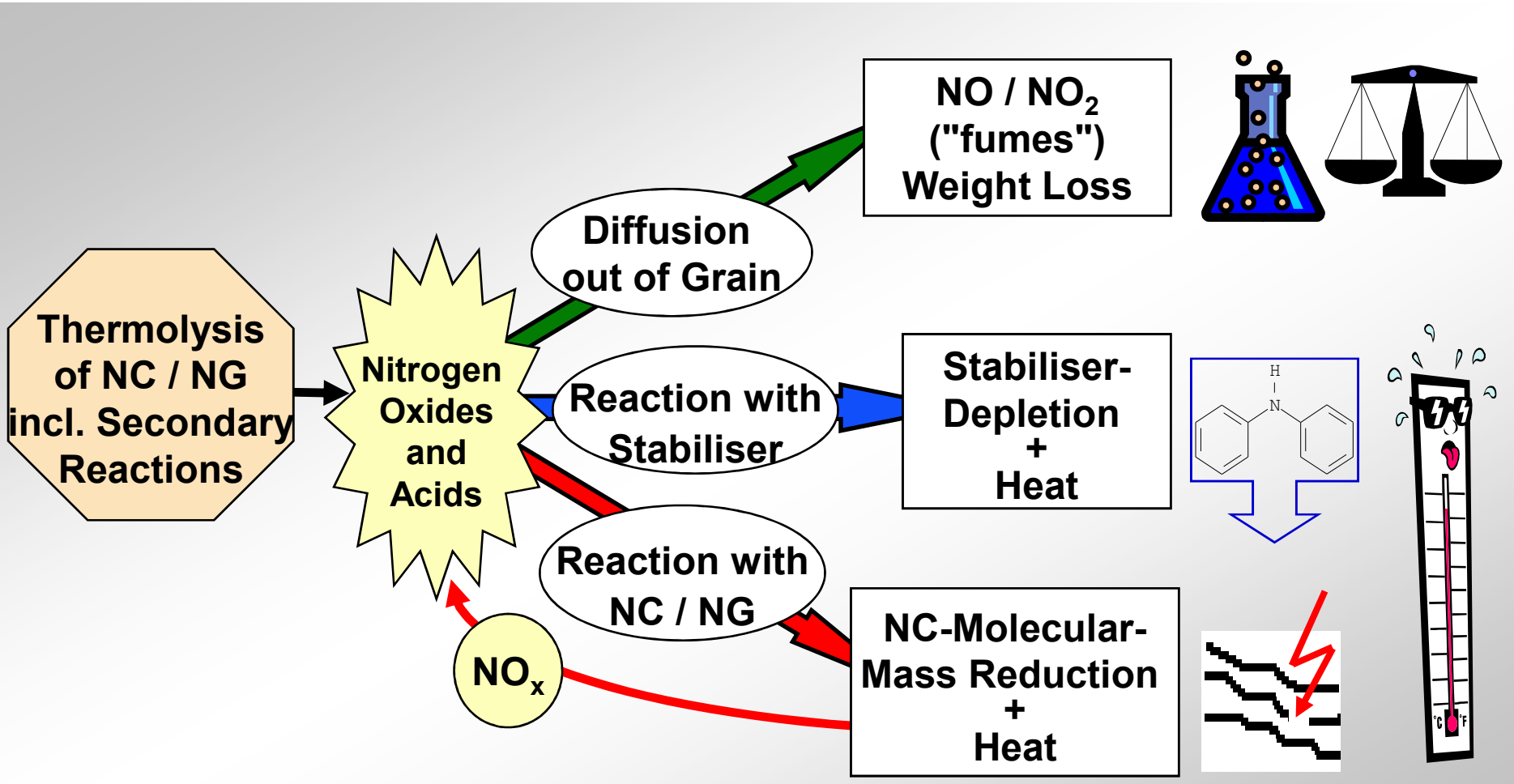
Beat Vogelsanger, Ruth Sopranetti

Introduction / Goal

- **This short presentation should demonstrate that nitrocellulose degradation plays an important role in the understanding of propellant ageing**

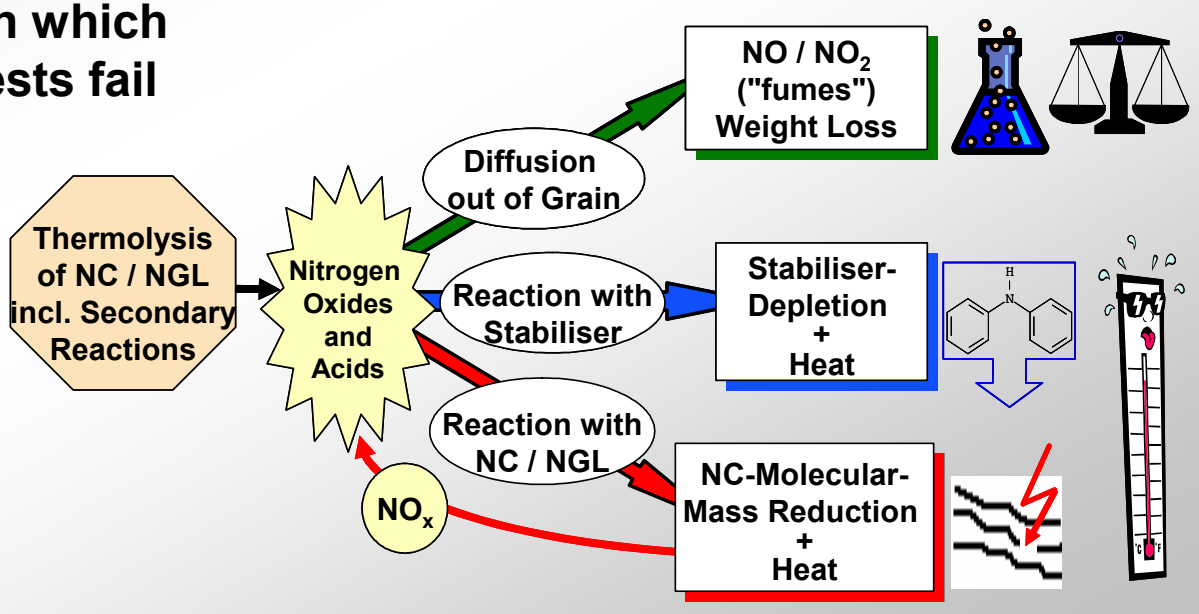
RHEINMETALL NITROCHEMIE

Chemical Ageing of Propellants
Phenomenological Description



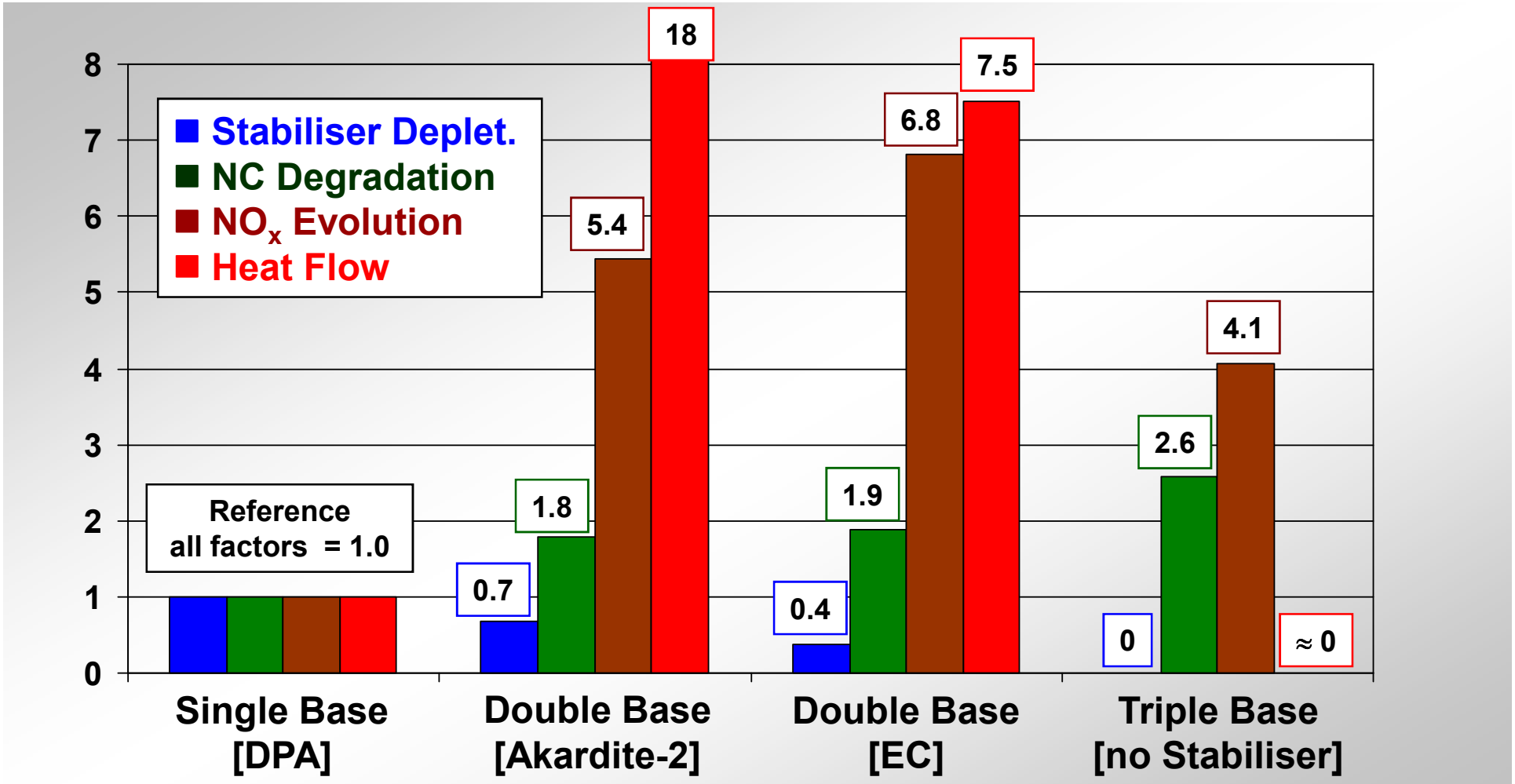
Chemical Ageing of Propellants
Preference for Certain Stability Tests

- Some institutes / testing laboratories have developed a strong preference for (or even addiction to) one single stability testing method
- This is very dangerous !
  - Chemical ageing of propellants involves many different physical-chemical processes
  - Most stability tests only regard one of these processes
  - There are cases in which certain stability tests fail



Chemical Ageing of Propellants

Example: Relative Ageing Rates at 71°C



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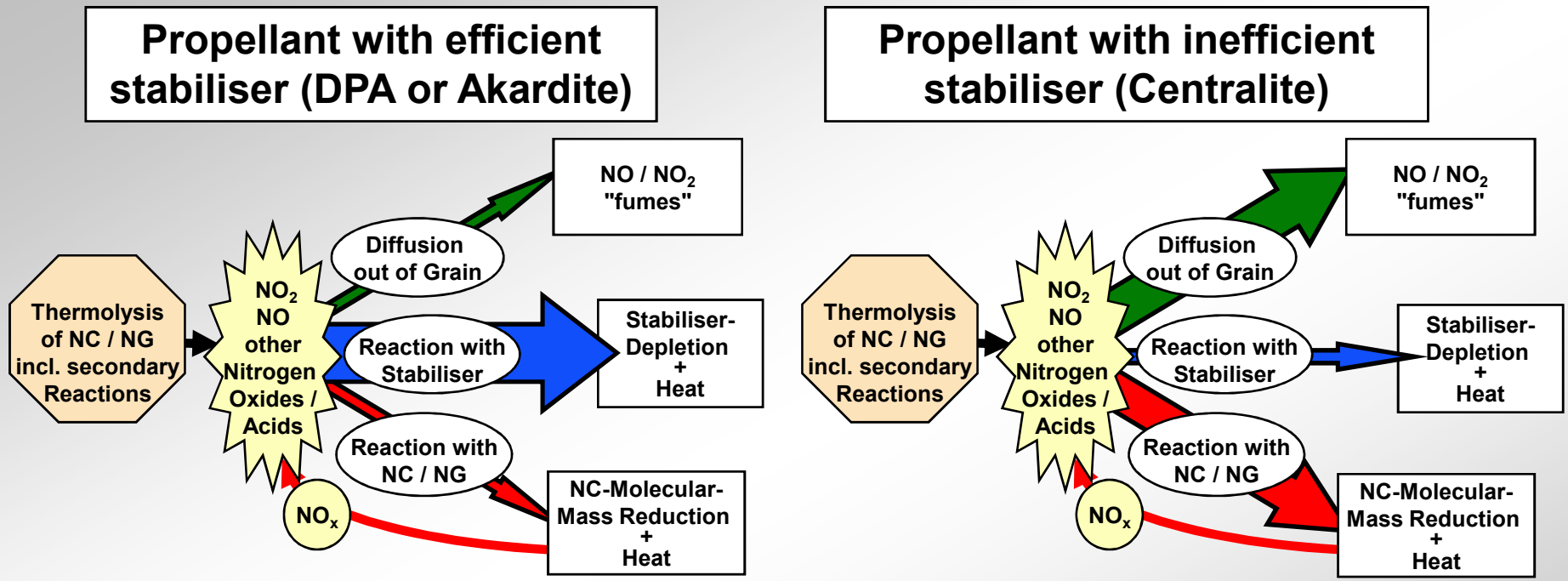
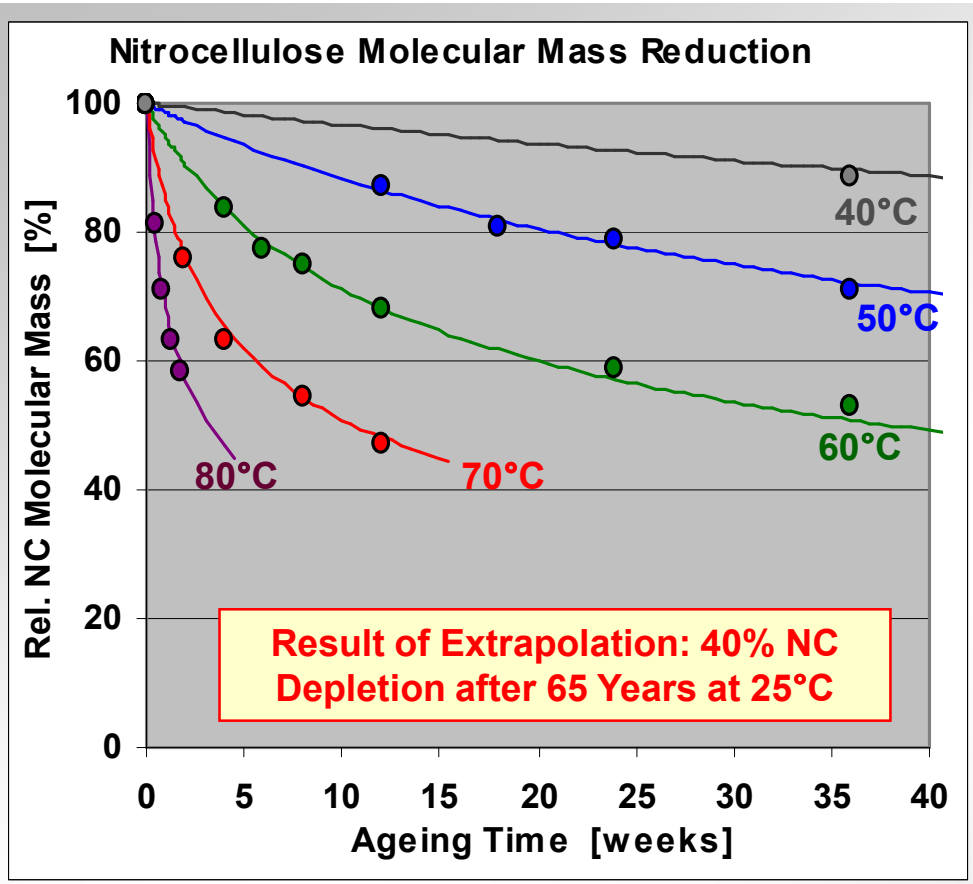
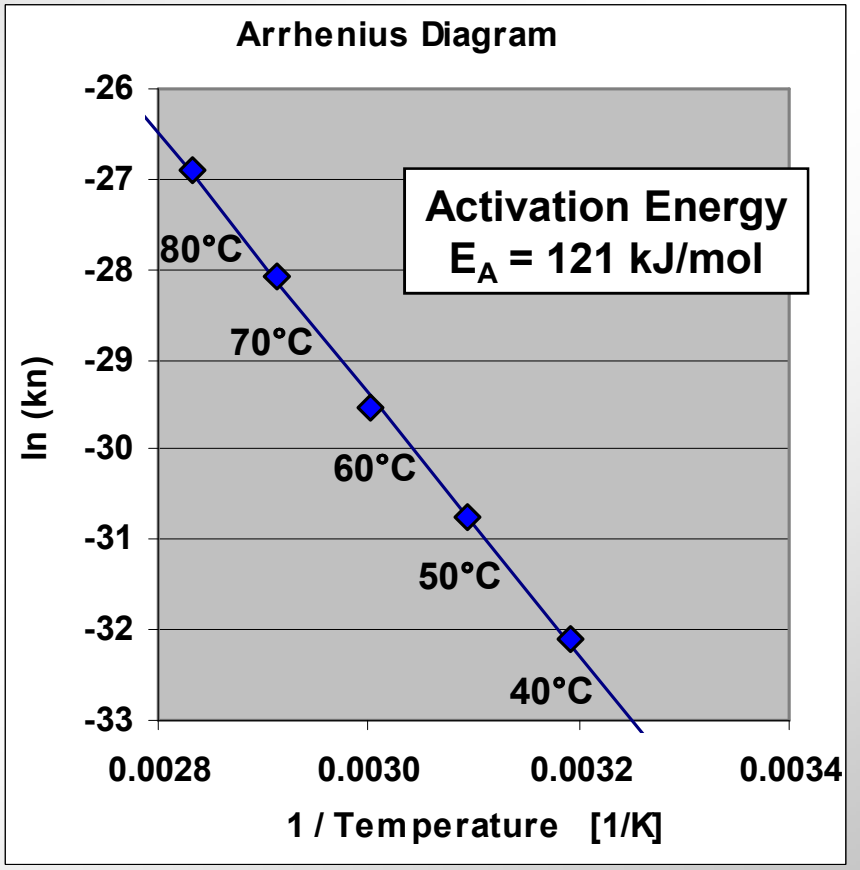
Chemical Ageing of Propellants
Influence of Stabiliser Type on Ageing



- Slowly depleting stabilisers are often inefficient an thus promote other ageing reactions (mainly nitrocellulose degradation) !
- Therefore, different ageing processes have to be investigated in order to obtain a complete picture of the propellant ageing !

Temperature Dependence of NC Molecular Mass Reduction





- Temperature dependence of NC molecular mass reduction can easily be analysed using n^{th} order kinetics + Arrhenius (such as for stabiliser depletion; see AOP-48 Ed. 2)

Summary and Conclusions

- **Nitrocellulose degradation**
  - **is a very robust indicator for chemical ageing of propellants**
  - **produces plausible results even in cases where the other test methods fail**

- **A sufficient understanding of chemical ageing of propellants requires investigation of different ageing processes, including nitrocellulose degradation**
  (apart from stabiliser depletion, heat production and gas / NO_x production)

Thanks very much for your attention !