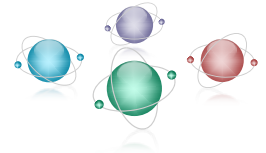


Safe Treatment of Organic Contaminated Spent Acids

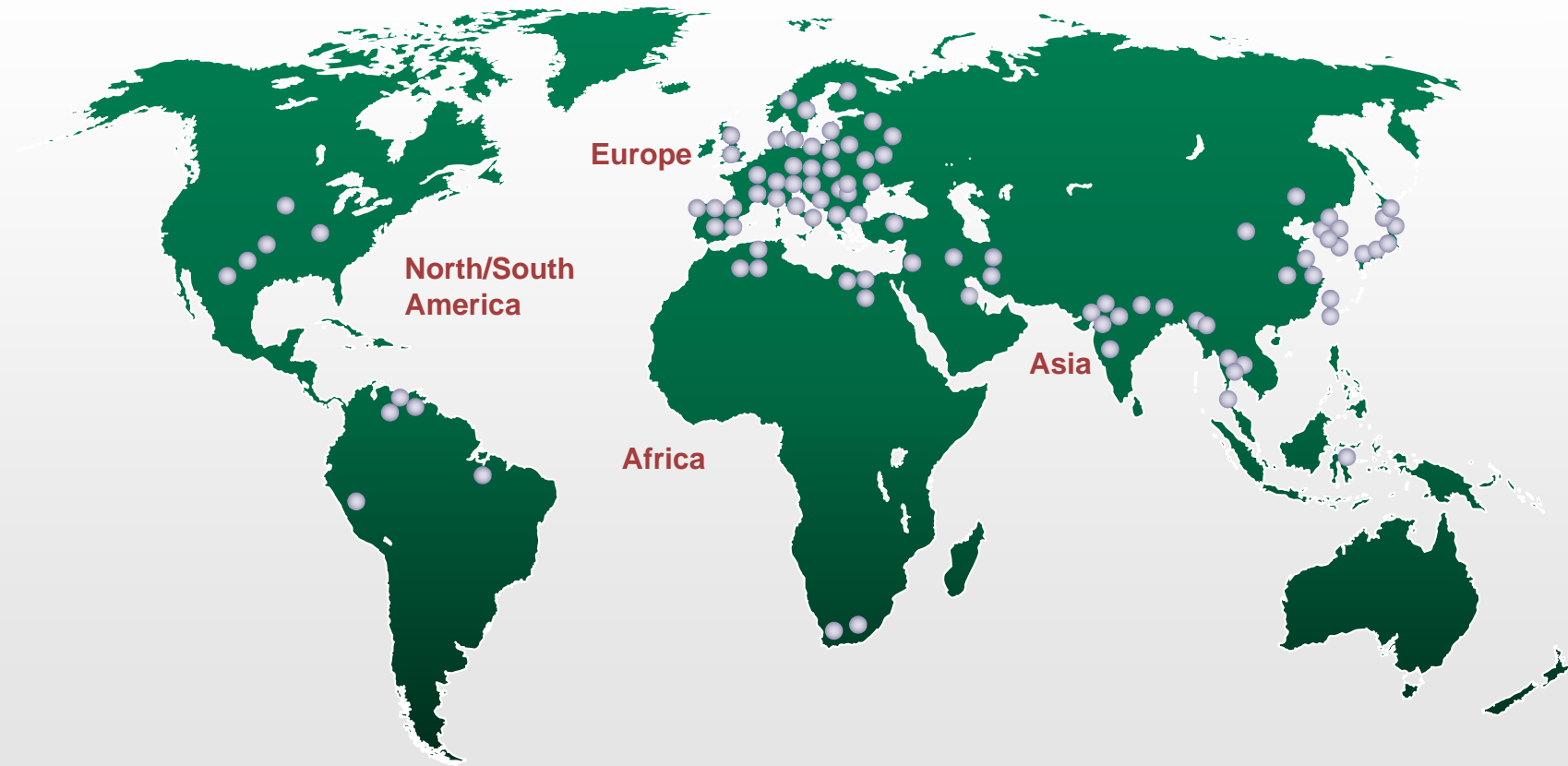
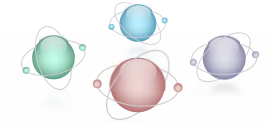
Dr. Hansjuergen Winterbauer
Director Development / Patents
PLINKE GmbH
Bad Homburg, Germany

The Company

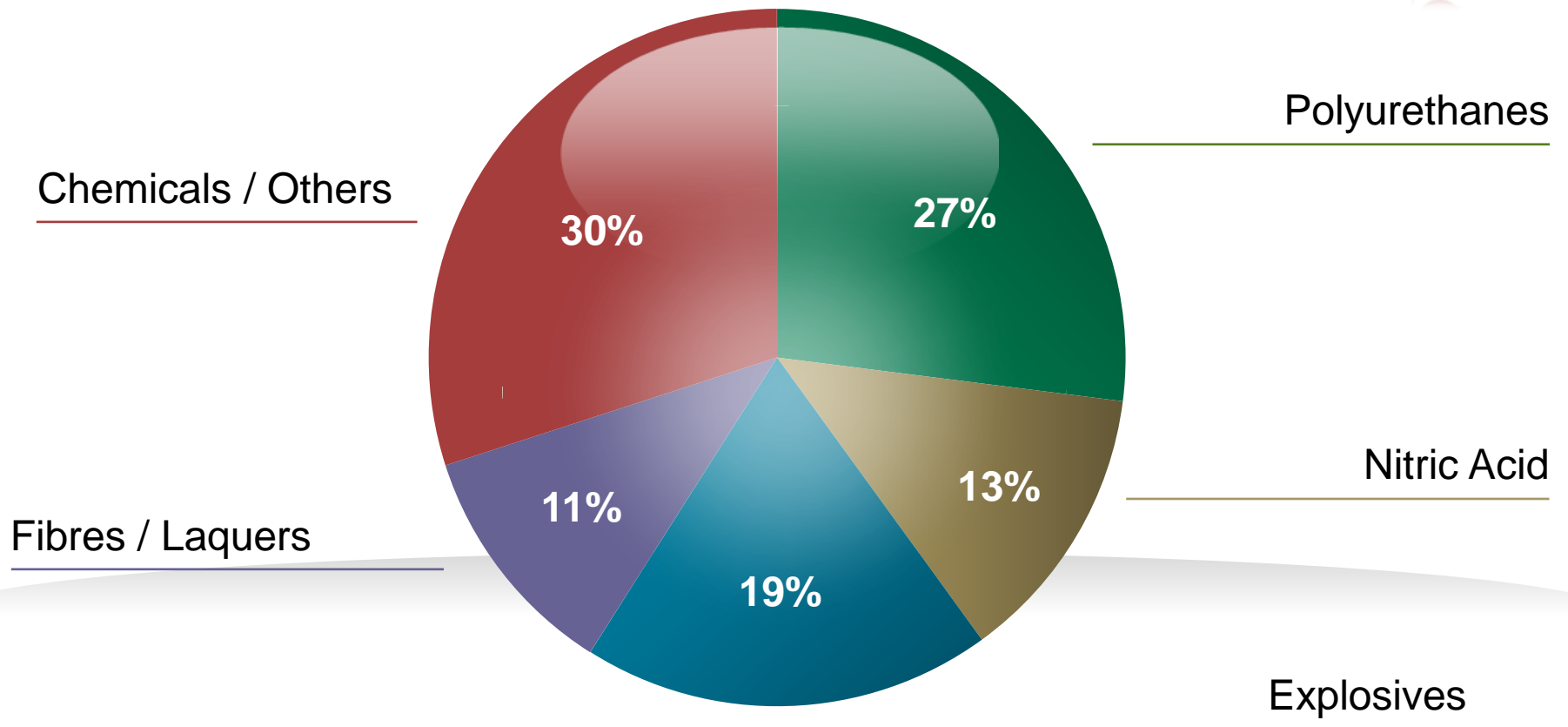
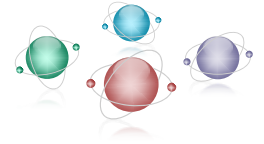
- Established 1947
- Independent engineering company, 35 employees
- Registered office at Bad Homburg, Germany
- World leading supplier of Acid Treatment Plants
- Most reference plants in this field world wide
- Member of Chematur Group



References



Industrial Applications (1994-2014)



Nitro-Ester (Propellants)

- ◆ **Nitrocellulose (NC)**
- ◆ **Nitroglycerine (NG)**
- ◆ **Nitroguanidine (Nigu)**

Nitro-Ester (Others)

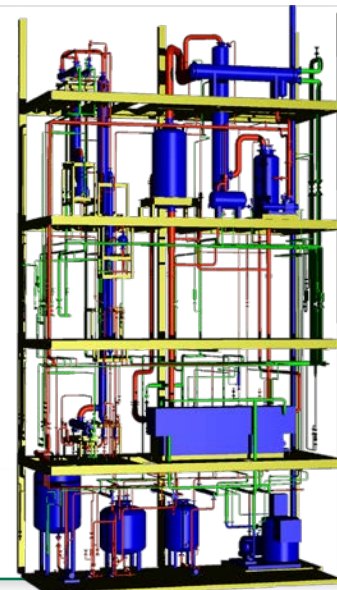
- ◆ **Ethyleneglycoldinitrate (EGDN)**
- ◆ **Diethylenglycoldinitrate (DEGDN)**
- ◆ **Metrioltrinitrate (MTN)**
- ◆ **Propyleneglycoldinitrate (PGDN)**
- ◆ **Butanetrioltrinitrate (BTTN)**

Nitric / Acetic Acid Based Explosives

- ◆ **RDX / HMX / PETN**

Nitroaromatics

- ◆ **Nitrobenzene (NB)**
- ◆ **Nitrotoluene (MNT)**
- ◆ **Dinitrotoluene (DNT)**
- ◆ **Trinitrotoluene (TNT)**
- ◆ **Picric Acid**



A small leak will sink a great ship.



Nitrocellulose Plant Taiwan 2013

Nitroglycerin as Example for Treatment of Nitro Ester

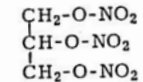
Main criteria for safe treatment:

- **General safety aspects**
- **Liquid phase decomposition**
- **Accelerating effects on decomposition**



Nitroglycerine

glycerol trinitrate; Nitroglycerin; nitroglycérine; trinitrate de glycérine; NG; NgI.



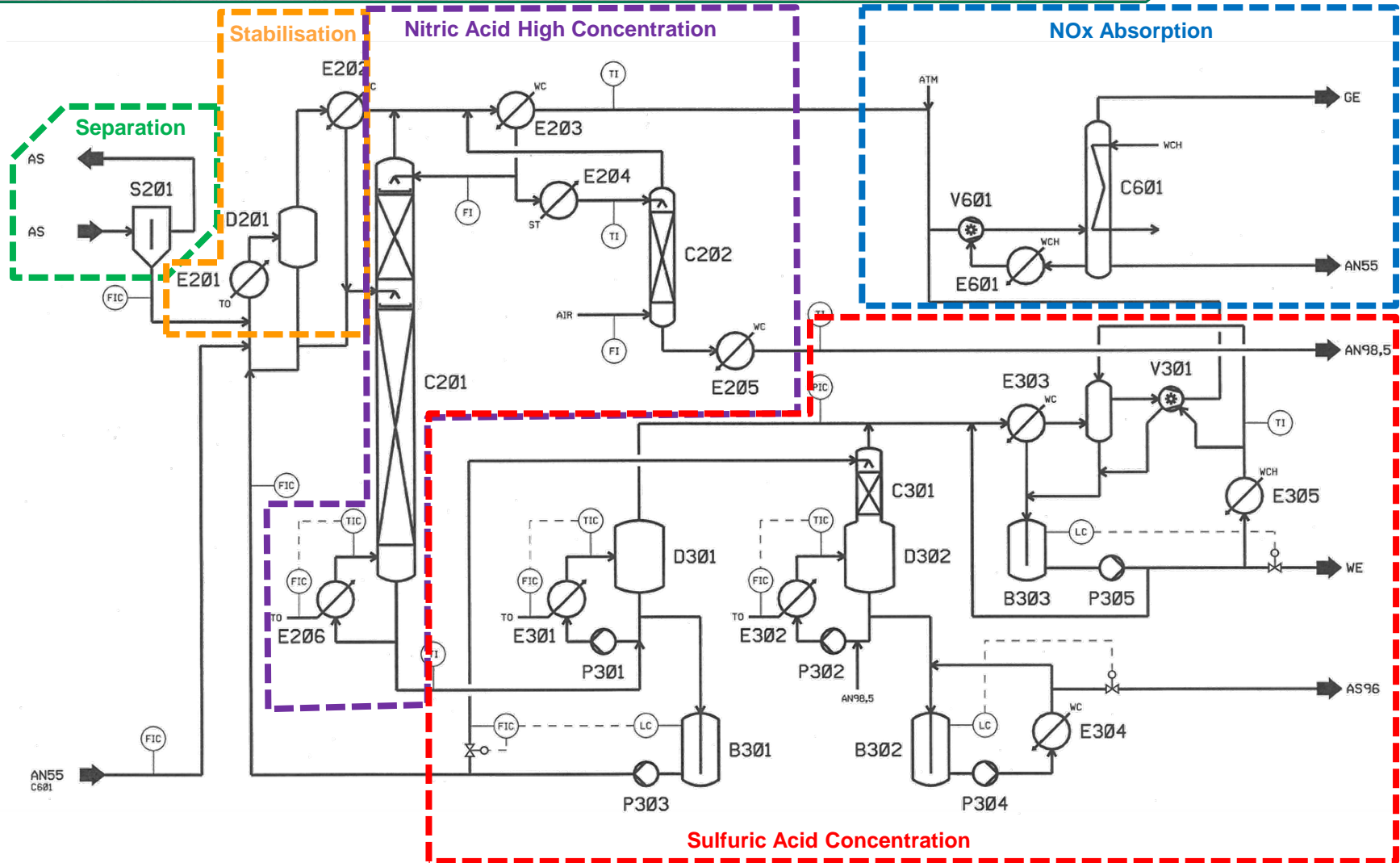
yellow oil

gross formula: $\text{C}_3\text{H}_5\text{N}_3\text{O}_9$

molecular weight: 227.1



Spent Acid Recovery Process



General Safety Aspects

- **Separation of not dissolved organic material**
- **Controlled complete decomposition**
- **Safe handling of gas development**
- **Selection of most suitable treatment conditions**

No dangerous compounds to enter the following steps!

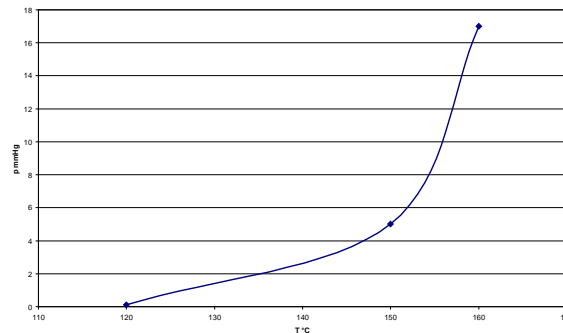


Liquid Phase Decomposition

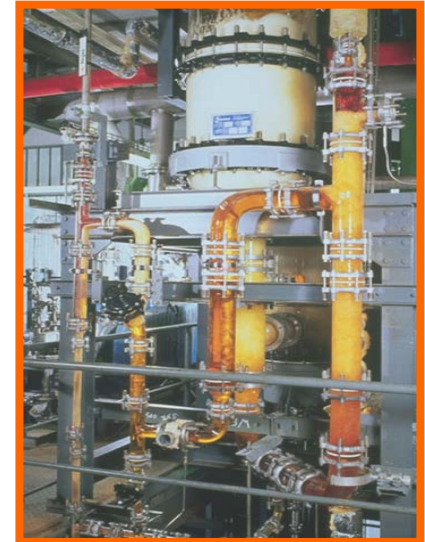


Liquid Phase Decomposition

- **Defined temperature for decomposition**
- **Suitable surplus of acid to remove the energy**
- **Gas cooler/condenser for maximum recovery**
- **Separation of gas**



vapor pressure of NG



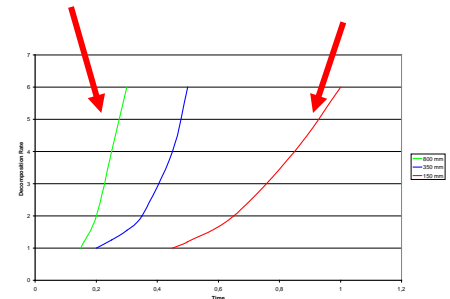
Accelerating Effects on Decomposition

Increasing the velocity of decomposition by making use of catalytic effects of decomposition by-products



- **HNO₃** ↗ **increase of velocity**
- **NO₂** ↗ **increase of velocity**
- **O₂** ↗ **increase of velocity**
- **H₂O** ↗ **increase of velocity**
- **NO** → **no influence**

High Concentration Low Concentration
Fast Reaction Slow Reaction



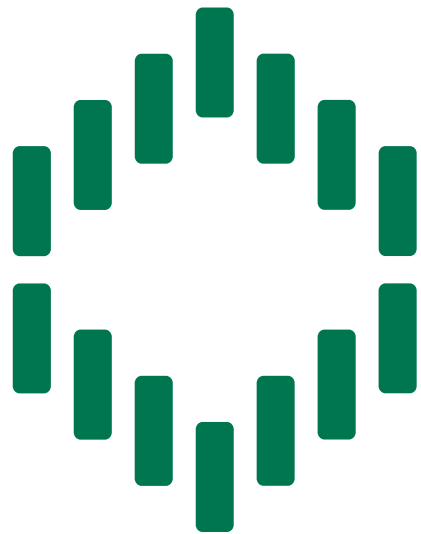
Influence of NO₂ on the Velocity of NG Decomposition

Accelerating Effects during Storage



to be avoided

Thank You



Plinke