

Ionic Liquids from BASF – Solutions for Your Success

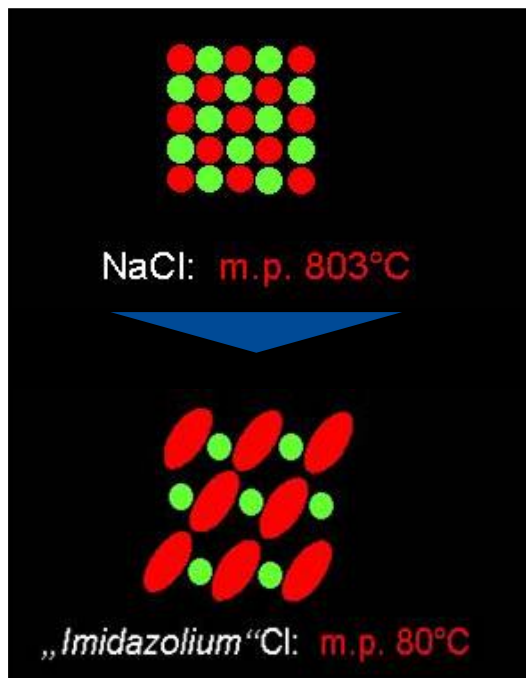
 **BASF**
The Chemical Company



Confidential

What are Ionic Liquids ???

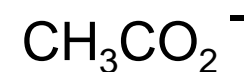
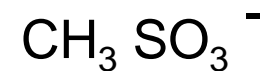
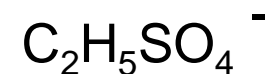
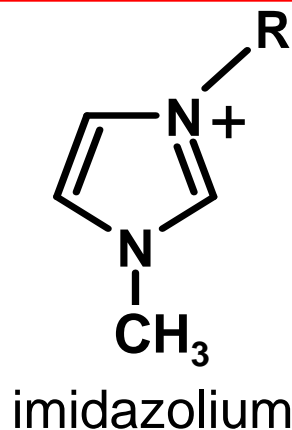
liquid salts
m.p. < 100°C
(often: < r.t.)



- literally no vapour pressure
- non flammable
- high therm. & mechan. stability
- broad liquid range
- electric conductivity
- high electrochem. stability
- exceptional diss. properties

BASF Standard Products

Imidazolium derivatives



EMIM Chloride

standard IL

BMIM Chloride

standard IL

EMIM Ethylsulfate

low viscosity & high thermal stability

EMIM Methanesulfonate

high thermal & chemical stability

EMIM Acetate

low viscosity & dissolution of cellulose

EMIM TFSI

low viscosity, electrochemical stability & hydrophobic

Know-how and experience in production of Ionic Liquids in large scale

- ➔ direct alkylation
- ➔ Methathesis
- ➔ Ion exchange → WO(BASF) 2005 / 08 52 07
- ➔ Carbonate route → WO (Proionic/BASF) 2005/ 021484



- ➔ ILs produced @ BASF
- ➔ in high quality and tons quantities
- ➔ adopted to customer needs
(e.g. [electrolyte for Aluminium Plating](#))

Application Segments



Chemical Processing



Separation Processes



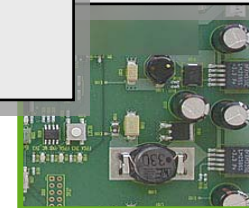
Metal Processing



**Engineering
& Functional Fluids**

Polymer Processing

Electrolytes



Example 1: Chemical Processing, BASIL

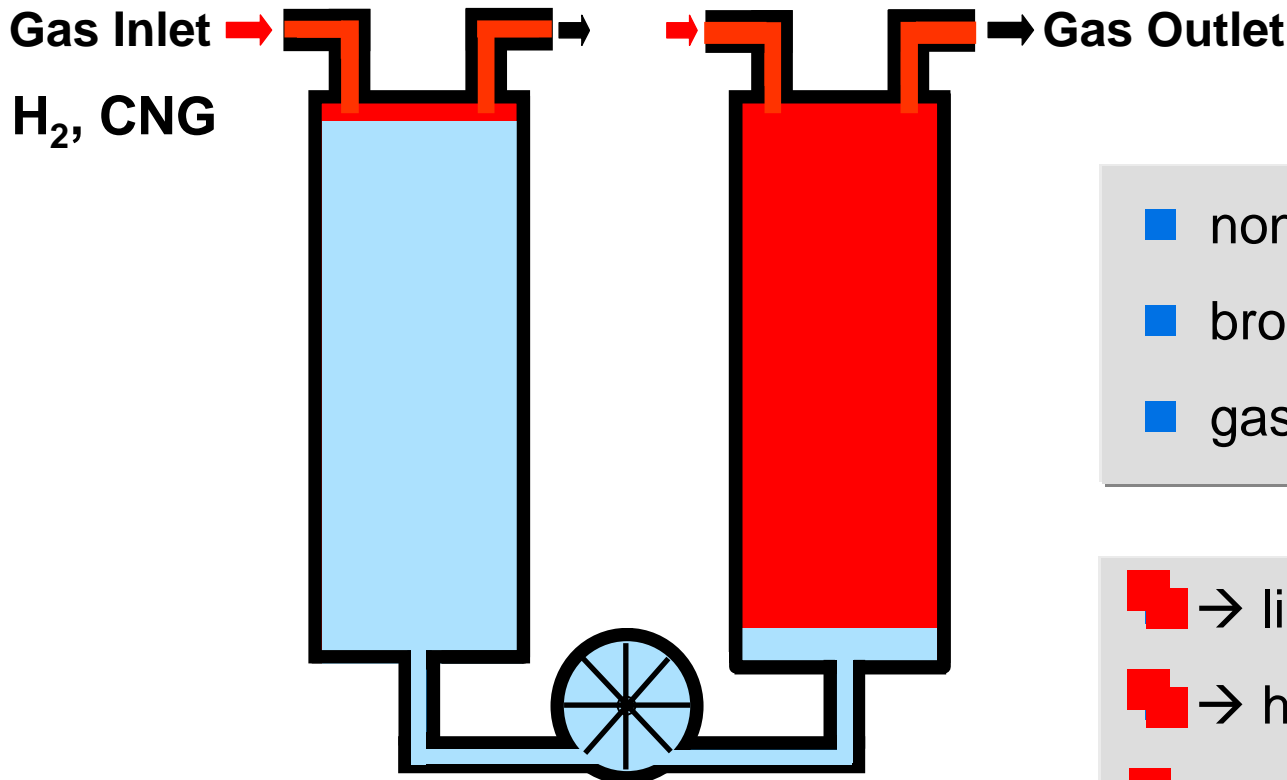
old process (with solids):
yield per volume and time unit
 $8 \text{ kg m}^{-3} \text{ h}^{-1}$

8×10^4
➔

yield per volume
and time unit
 $690.000 \text{ kg m}^{-3} \text{ h}^{-1}$



Example 2: Hydraulic Liquid „Ionic Compressor“



- non volatile
- broad liquid range
- gas insolubility

- → liquid piston
- → heat removal
- → isothermal compression
- → 1 to 1.000 bars in 1 step

Example 3: Electrolyte in Dye Solar Cells

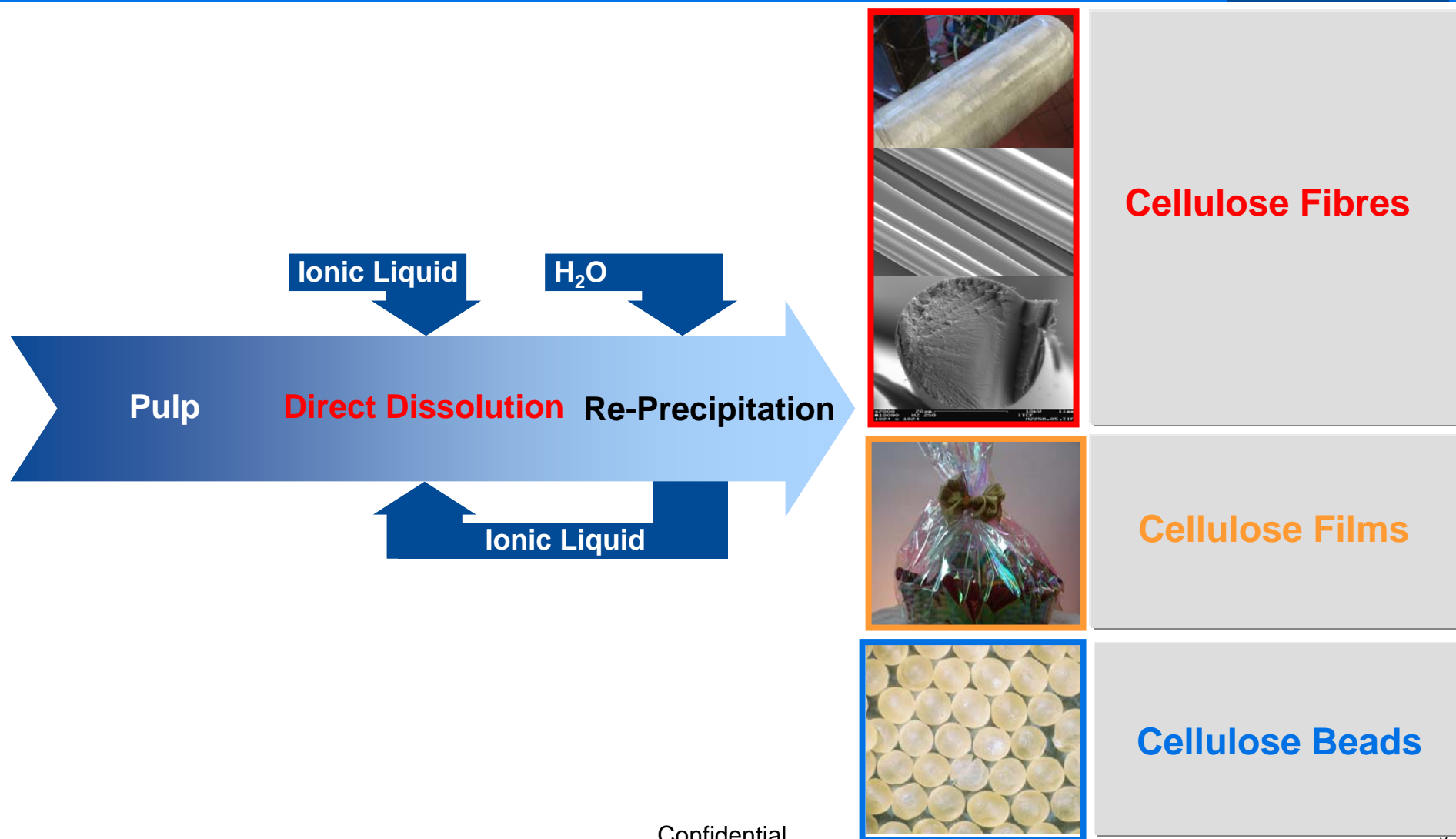
G24i site in Cardiff, UK

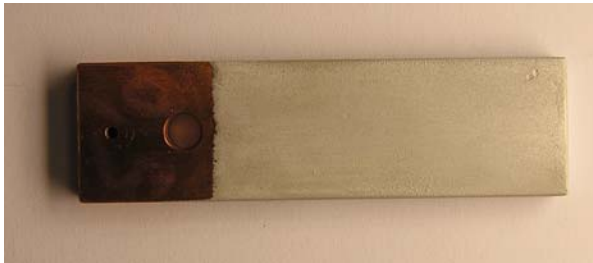


www.g24i.com



Example 4: New Process for Re-Shaping Cellulose





➔ 10µm Aluminium on Copper



➔ 10µm Aluminium on Steel

Performance

- ➔ robust process
- ➔ dense and uniform Al-layer
- ➔ excellent adhesion
- ➔ customized finish
- ➔ high speed process (8 A/dm²)

BASF offer

- ➔ customized electrolyte supply
- ➔ technical support and expertise

IL based electrolyte available

toxicity & ecotoxicity has been evaluated

→ best choice: **Ethyl-methyl-imidazolium (EMIM) salts**

→ non-toxic, some of them even not hazardous at all

dermal toxicity of all IL's tested so far is considerably low

so far no effects on mutagenicity observed

most IL's are not readily biodegradable

unless they contain functional groups (e.g. cholinium)

REACH - Fundamentals

- REACH = Registration, Evaluation and Authorisation of Chemicals

- objectives:
 - differentiation between new and existing substances shall be deleted
 - inventory of existing substances (EINECS) shall be successively abolished
 - all substances manufactured / imported with 1 tonne/yr or more have to be registered
 - risk assessment for specific application

- consequences:
 - after transition period (11 years after entry into force) EINECS no longer exist
 - only registered substances can be manufactured or imported

REACH - pre-registration and phase-in status

- new Substances **produced before June 1, 2007** and **placed on the market after June 1, 2007** are treated like existing chemicals
 - phase-in substance under REACH
 - free marketing after pre-registration
 - registration deadline is triggered by the tonnage band

- new Substances **produced** and **placed on the market before June 1, 2007**
 - non Phase-in substance under REACH
 - first registration before marketing
 - or a PPORD (5 +5 yrs) has to be applied for

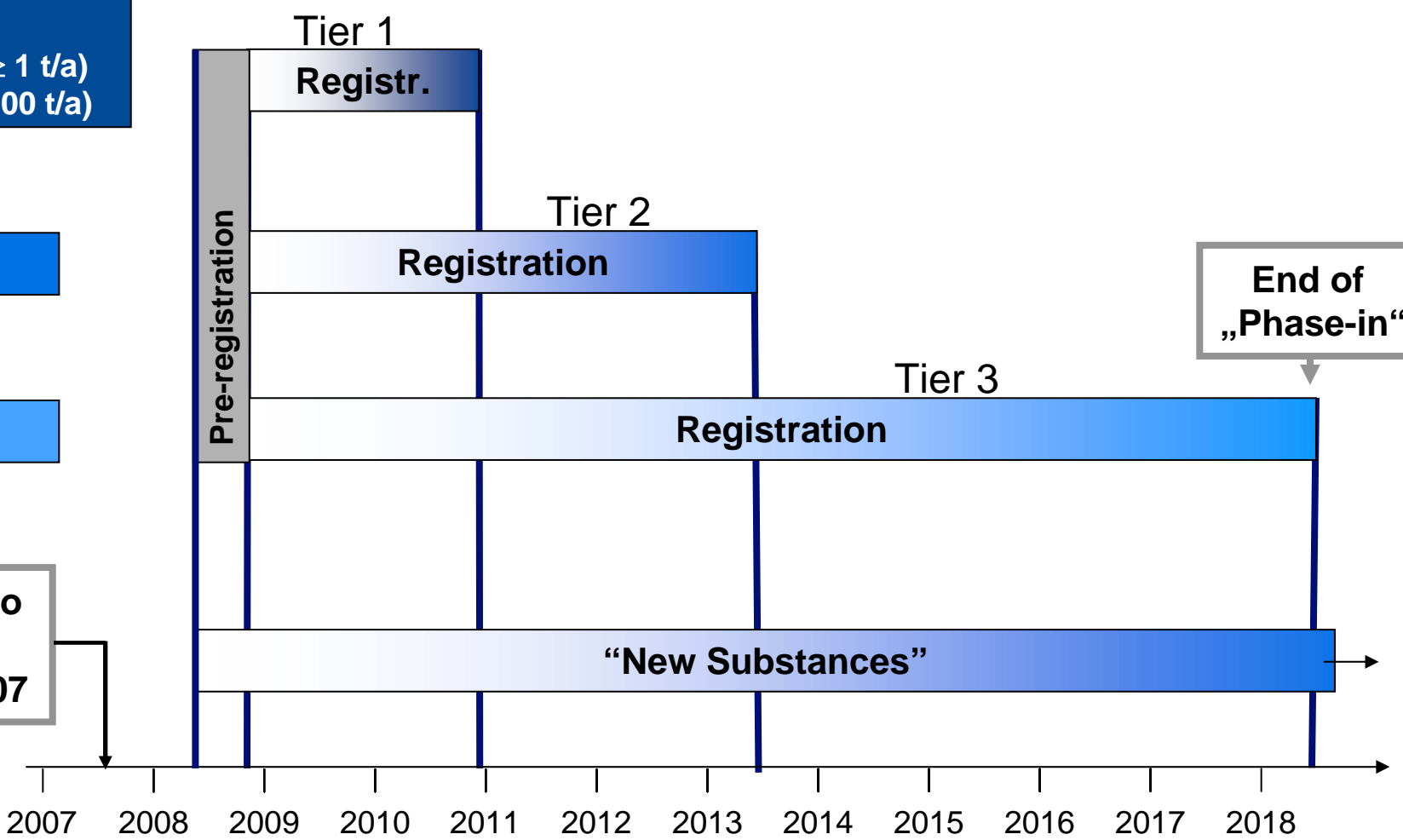
REACH – timelines & tonnage bands

≥1000 t/a
CMR 1+2 (≥ 1 t/a)
R50-53 (≥ 100 t/a)

≥ 100 t/a

≥ 1 t/a

Entry into force:
01.06.2007



Status REACH registration



these products are already registered respectively in the process of registration or pre-registration

EMIM Chloride

standard IL

BMIM Chloride

standard IL

ELINCS

EMIM Ethylsulfate

low viscosity & high thermal stability

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low viscosity & dissolution of cellulose

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low viscosity, electrochemical stability & hydrophobic

TFSI = bis(trifluoromethylsulfonyl)imide