Getting ready for 21st century photochemistry - Teaming up continuous flow and LED

Clemens R. Horn - Carine Cerato Noyerie - Jie Ao - Olivier Lobet - Sylvain Gremetz

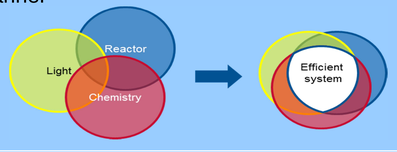
Corning SAS, Corning European Technology Center, 7 bis Avenue de Valvins, CS 70156 SAMOIS SUR SEINE, 77215 Avon Cedex, France

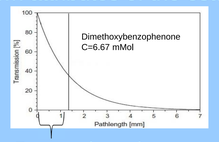
e-mail:hornc@corning.com

Flow reactor vs Batch reactor

The **Corning® Advanced-Flow™ G1 Photo Reactor** is the combination of Corning® Advanced-Flow™ G1 Reactor and a LED lighting module. It applies the known attributes of the established G1 reactor to flow photochemistry :

- Better mass transfer performance
- Improved heat management
- More homogeneous absorption of light through the depth of the reaction channel
- LED lighting

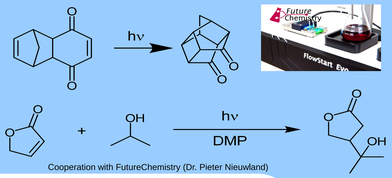




Reactor channel

Scaling up to pilot size – easy and straight forward

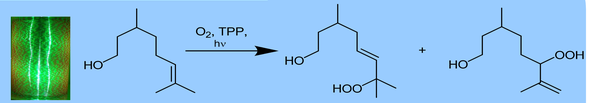
From Microreactor



Cooperation with FutureChemistry (Dr. Pieter Nieuwland)

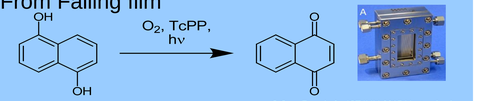
Scale up:
Up to 400 times

From tube reactor



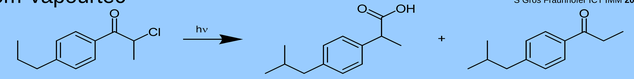
F. Lévesque, P. H. Seeberger *Org. Lett.* **2011**, *13*, 5008–5011

From Falling film



S Gros Fraunhofer ICT IMM **2015** Master thesis

From Vapourtec

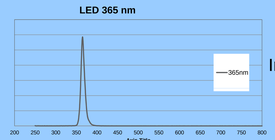


M. Baumann, I. R. Baxendale *React. Chem. Eng.* **2015 DOI:** 10.1039/C5RE00037H

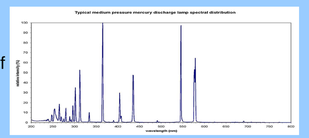
LED a «clean» and energy saving light source

Chemistry A+B → C Photo Chemistry A + Light → C

In Chemistry you use clean starting material.
Why not using a clean light source ?

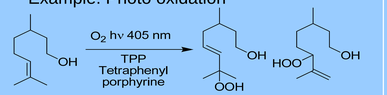


Instead of



Let chemistry choose your wavelength, and not the light source choose your chemistry !

Example: Photo oxidation



For 1 kg intermediate	Batch* kWh	AFR kWh
Light energy	10	3.0
Cooling energy	9.3	4.9

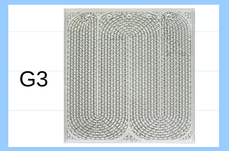
60% energy savings

*N. Monnerie, J. Ortner J. Sol. Energy Eng. 2001, 123, 171; DE 19645922A1

From pilot size to production

V= 8 ml

Seamless scale up:
Mass, heat, transfer
Light intensity



V= 60 ml

The combination of Corning controllable LED lighting and transparent glass flow reactor enables more energy-efficient photo chemistry with excellent process scalability