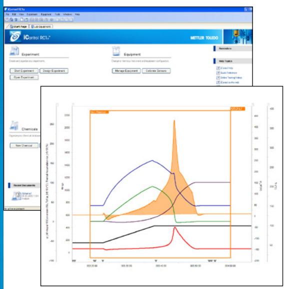
Intelligent Software

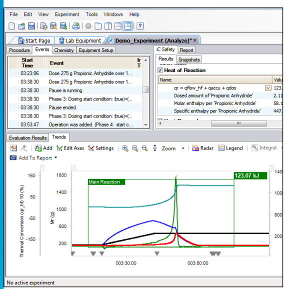
Evaluating Thermal Risk

Streamline Safety Analysis



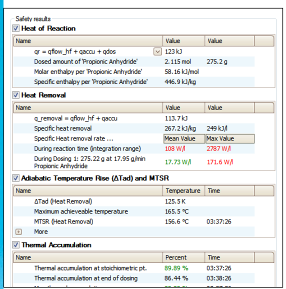
Process Understanding

A simple experiment using the Reaction Calorimeter RC1$_e$® provides reliable data to calculate safety relevant parameters, with the highest degree of confidence. iC Safety makes the conversion of experimental data into safety information simple, helping chemists and chemical engineers to understand the potential hazards of a chemical process faster.



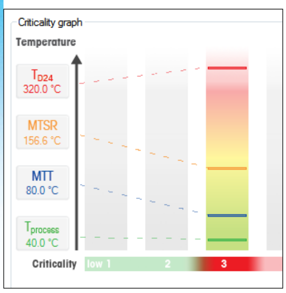
Safety Analysis

The safety runaway graph describes both the desired and the undesired reaction in the event of a cooling failure. It factors in the most important safety information, is easy to interpret, and provides the base for a full safety assessment. The safety runaway graph represents a fast check of the nature of thermal risks linked to a given process.



Risk Assessment

In-depth understanding of the exothermicity of a chemical reaction is essential to make adjustments to the process. iC Safety presents the thermal risk, such as thermal accumulation, ΔTadiabatic or MTSR in a concise and understandable format, enabling the appropriate conclusions to be made and the necessary measures to be taken.



Inherently Safer Processes

The criticality graph in iC Safety is a visual representation of the most crucial temperatures of a process. It classifies the process based on four characteristic temperatures. The resulting criticality class is one of the bases which help the engineer to estimate the hazardous potential and define adequate measures to make the process safe.

iC Safety™ – Critical Safety Information in One Click

The chemical and pharmaceutical industries often use complex products and processes in which large amounts of energy can be released. Process development is concerned with risks related to scale-up and manufacturing the product. Knowing and understanding the potential risks is critical, and a pre-requisite for the safe manufacturing of chemical and pharmaceutical products.

iC Safety is an intuitive application that utilizes experimental data from the Reaction Calorimeter RC1$_e$® and other calorimetric techniques. It is designed to speed and simplify the calculation of thermal safety values associated with chemical reactions. Better understanding of the thermal risks help the engineer to estimate the hazardous potential more easily, and to develop safe chemical processes faster.

METTLER TOLEDO

Evaluating Thermal Risk
Streamline Safety Analysis

iC Safety is a crucial tool for evaluating the thermal risk of a chemical reaction at industrial scale. Designed for use by both non-expert and expert users, it summarizes key safety information in an easy-to-understand graphical and tabular format, while providing access to detailed safety data needed by expert users.

Transforming Data into Information
iC Safety uses well established algorithms* and procedures to automatically convert reaction calorimetry data into safety information. The basic iC Safety information can be complemented with experimental data from other calorimetric measurements, such as DSC or adiabatic calorimetry as well as properties of the reaction mixture, to increase its significance.

Characterize the Risk
The severity of a runaway reaction is directly linked to the energy of the reaction. Hence, the adiabatic temperature rise in case of a cooling failure, the maximum temperature of the synthesis reaction (MTSR) or maximum achievable temperature (MAT) are important parameters to know. When the basic iC Safety information of the desired reaction is combined with data from the undesired reaction, the hazardous potential of the chemical can be described in a more detailed way, and the necessary conclusions can be drawn.

The information obtained is presented as numbers, trends and schematics that correlate to the relative position of critical temperatures. iC Safety automatically converts them into important charts known as "Safety Runaway Graph" and "Criticality Graph".

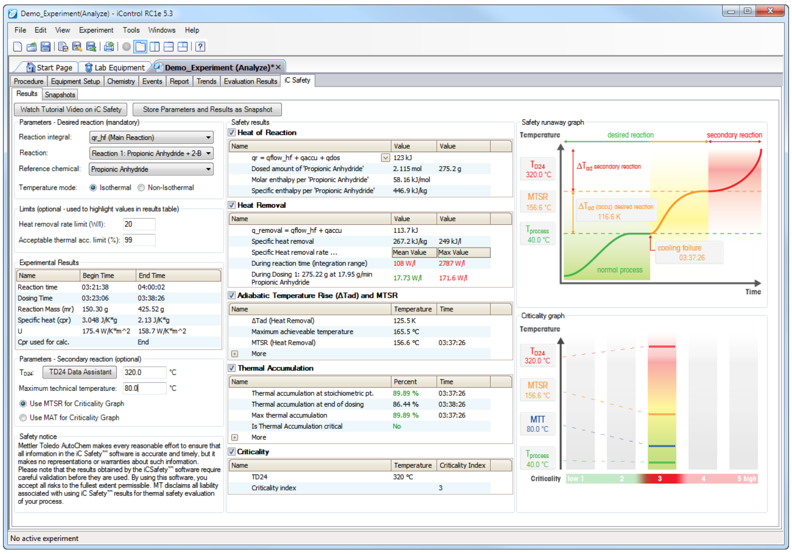
How it Works
Following the basic evaluation of experimental data and reaction chemistry, iC Safety calculates the relevant safety parameters for the desired reaction. The results are presented conveniently in a table and the "Safety Runaway Graph" is created.

The TD24
assistant helps the user to integrate data from either DSC, ARC or other calorimetric techniques describing a potential secondary reaction that may occur in case of a cooling failure. In the event of multiple evaluations, all data sets are captured in a convenient table to allow simple comparison of the result sets.

Requirements to Operate iC Safety

- Reaction Calorimeter RC1e with either the option "Heat Flow" or "RTCal"
- iControl RC1e 5.3 Software

* Thermal Safety of Chemical Processes, Francis Stoessel, Wiley-VCH, 2008, ISBN: 978-3-527-31712-7



Technical Specifications

PC Requirements	Single iC Application	Multiple iC Applications
Operating System	Microsoft® Windows® 8.1 (32/64-bit), Microsoft® Windows® 7 (32/64-bit)	
CPU	Intel Core 2 Duo 2.2 GHz or better	Intel Core 2 Duo 2.8 GHz or better
Memory	2 GB memory space	3 GB memory space
Hard Disk	SATA 5400 rpm hard drive	SATA 7200 rpm hard drive
Graphics	SXGA 1280 x 1024 with 3D Hardware Acceleration	
Additional Software	Internet Explorer® 8.0 Web Browser or later Microsoft® Office® 2007, 2010, or 2013 The latest version of Adobe® Reader® or other PDF reader	

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Supported Experiments

iC Safety 5.3 is applicable to all experiments carried out with iControl 5.0 or 5.3 containing calorimetry information. These data can origin from either a heat flow experiment or an RTCal experiment

Accelerate Development with iC Suite
The iC Suite of software products support METTLER TOLEDO *in situ* spectroscopy, particle system characterization, precise reactor control and calorimetry. iC software integrates your entire experimental workflow, making it simple to visualize, interpret and report your results.

- **Intuitive, consistent user interface**
- **Seamless integration between products**
- **Easily transform data into information**

To learn more visit **www.mt.com/iC**

Mettler-Toledo AG, AutoChem
Sonnenbergstrasse 74
CH-8603 Schwerzenbach, Switzerland
Phone +41 44 806 7711
Fax +41 44 806 7290

Email: autochem@mt.com
Internet: http://www.mt.com/autochem

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