

# Technical Data Sheet

## Kinetics Lite 1.0 ([kineticslite.netzsch.com](http://kineticslite.netzsch.com))



### At a Glance – Highlights of Kinetics Lite

Purpose	<p>Kinetics Lite is a 64-bit software for studying chemical kinetics (reaction kinetics). It investigates the reaction rates of chemical processes depending on temperature, including autocatalytical curing, aging, and decomposition.</p> <p>Kinetics Lite contains 6 well-known model-free methods.</p> <p>Kinetics Lite features a unique model-based method for automatic determination of reaction types for single-step reactions and making predictions and optimizations based on this model.</p>
Kinetic analysis	<p>The software uses both model-free and model-based methods. The results of these methods can be statistically compared with one another.</p> <p>Model-free methods determine the activation energy as functions of the conversion degree.</p> <p><b>Model-based methods determine the single-step kinetics model including parameters for each reaction step:</b></p> <ul style="list-style-type: none"><li>▪ Reaction type</li><li>▪ Activation energy</li><li>▪ Reaction order</li></ul>
Predictions	<p>Based on results of the model-free method or on the created kinetic model, the software simulates the reaction rate and conversion for isothermal or constant heating conditions at a user-defined temperature and heating rate.</p> <p>This allows for prediction of the sample properties for temperature conditions which differ from the originally measured conditions.</p>

### System Requirements, General Data of the Software

Operating systems	x64 versions Microsoft Windows 11, Windows 10 and Windows 7
Application language	English
Integrated help system	Context-sensitive, browser-style HTML help interface
Minimal hardware requirements	Desktop PC, laptop or tablet PC; Intel® Core i5 processor, 8 GB RAM, hard disk space 120 MB, display 1440 x 1050
Software delivery	as <i>Proteus</i> ® option

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### Data for Analysis

Data type for kinetic analysis	<ul style="list-style-type: none"> <li>■ DSC</li> <li>■ TGA</li> </ul>
Number of measurement data curves	Unlimited
Data loading	Data can be loaded only from <i>Proteus</i> ® Analysis software containing the purchased Kinetics Lite option

### Model-Free Methods

Definition	Model-free analysis allows to find the activation energy of the reaction without assumption of a kinetic model for it.
Methods based on a single conversion	<ul style="list-style-type: none"> <li>■ ASTM E698</li> <li>■ ASTM E2890</li> <li>■ ASTM 1641</li> </ul>
Conversion-dependent Methods	<ul style="list-style-type: none"> <li>■ Friedman</li> <li>■ Ozawa-Flynn-Wall (OFW)</li> <li>■ Vyazovkin for dynamic data</li> </ul>
Results	<ul style="list-style-type: none"> <li>■ Analysis graph</li> <li>■ Plot of activation energy vs degree of conversion</li> <li>■ Conversion fit and R<sup>2</sup> fit quality</li> </ul>

### Model-Based Methods

Kinetic models	<ul style="list-style-type: none"> <li>■ Automatic determination of a reaction type for single-step models</li> <li>■ Selection of alternative reaction types</li> <li>■ Optimization of kinetic parameters for the single-step kinetic model</li> </ul>
Reaction types	<p>Single-step model can be one of 10 reaction types including</p> <ul style="list-style-type: none"> <li>■ Reaction of 1<sup>st</sup>, 2<sup>nd</sup> and n-th order without autocatalysis</li> <li>■ Reaction of 1<sup>st</sup>, and n-th order with autocatalysis including Kamal-Sourour reactions</li> <li>■ 2-/3-/n-dimensional nucleation according to Avrami</li> </ul>
Kinetic results	<p>The software determines the <b>standard parameters for single reaction steps</b>:</p> <ul style="list-style-type: none"> <li>■ Reaction type</li> <li>■ Activation energy</li> <li>■ Reaction order</li> </ul> <p><b>Additional parameters for some reaction types</b></p> <ul style="list-style-type: none"> <li>■ Order of autocatalysis</li> <li>■ Dimension of nucleation</li> </ul>
Stastical results	<ul style="list-style-type: none"> <li>■ Fit quality R<sup>2</sup></li> <li>■ Sum of the squares of deviations</li> <li>■ Mean residual</li> <li>■ t-value</li> <li>■ F-test for fit quality</li> </ul>

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### Predictions

Isothermal predictions	Predictions for several isothermal temperatures
Isothermal lifetime predictions	Predictions for given conversion at several isothermal temperatures
Dynamic prediction	Predictions for several heating rates
Results of prediction according to the user-defined temperature program	<p>After input of the temperature program by the user, the software will make a simulation of the system behavior.</p> <p>The following values can be simulated:</p> <ul style="list-style-type: none"> <li>■ Measurement output (signal)</li> <li>■ Conversion</li> </ul> <p>The simulated values can be presented as:</p> <ul style="list-style-type: none"> <li>■ Curves as a function of time</li> <li>■ Curves as a function of temperature</li> <li>■ a table with simulated values, time and temperature</li> </ul>

### File Operations, Graphics and Export

Graphical presentation of data and results	<p>Presentation of the data in graphic format having X-axes as temperature, time, or logarithm of time.</p> <ul style="list-style-type: none"> <li>■ Measurement output (signal)</li> <li>■ Conversion</li> </ul>
Graphical options	<ul style="list-style-type: none"> <li>■ Selection of the visual theme for the user interface</li> <li>■ Add vertical and/or horizontal grid</li> <li>■ Add legend</li> <li>■ Add any number of arbitrary text blocks to the graphics</li> <li>■ Add model scheme</li> </ul>
Export	<p>For all data, analysis results, predictions and for model-free plots, the following operations are enabled:</p> <ul style="list-style-type: none"> <li>■ ASCII export of results including measured data and simulated curves as well as activation energies for model-free analysis</li> <li>■ Copy graphics to clipboard</li> <li>■ Saves graphics as a picture to PNG format</li> </ul> <p>For model-based analysis:</p> <ul style="list-style-type: none"> <li>■ Equations for reaction rate for single reaction step in the kinetic model</li> <li>■ Equations for concentrations of reactant and product</li> <li>■ Balance equation for total signal such as DSC/TGA</li> <li>■ Copy the image of model to clipboard</li> <li>■ Export model into file graphics as a picture to PNG format</li> </ul>

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