

Leading Thermal Analysis ■

Identify ... the Next Stage (from *Proteus*® 8.0)

1. Enlarged Database (> 2000 db entries available)
2. Combined and Simultaneous Signals
(TGA+DSC, TGA+c-DTA®, STA)

■ Curve-/Material Identification



■ Quality Control (QC)



■ Archiving/Searching „Data Mining“



Identify makes
interpretations:

- easier
- faster
- more significant

01 Database Content (09/2018)

Identify: Database Status 2018 (Proteus® 8.0)

More than 2000 db entries available!

NETZSCH

NEW!

Search Libraries:

Library	Entries	
+ Literature Data Poster NETZSCH	248	
Ceramics_Inorganics NETZSCH	302	<input checked="" type="checkbox"/>
Metals_Alloys NETZSCH	143	<input checked="" type="checkbox"/>
Organics NETZSCH	172	<input checked="" type="checkbox"/>
Pharma_Food_Cosmetics NETZSCH	165	<input checked="" type="checkbox"/>
Phase Change Materials	14	<input checked="" type="checkbox"/>
Polymers DSC KIMW	800	<input checked="" type="checkbox"/>
Polymers NETZSCH	190	<input checked="" type="checkbox"/>

NETZSCH

User*

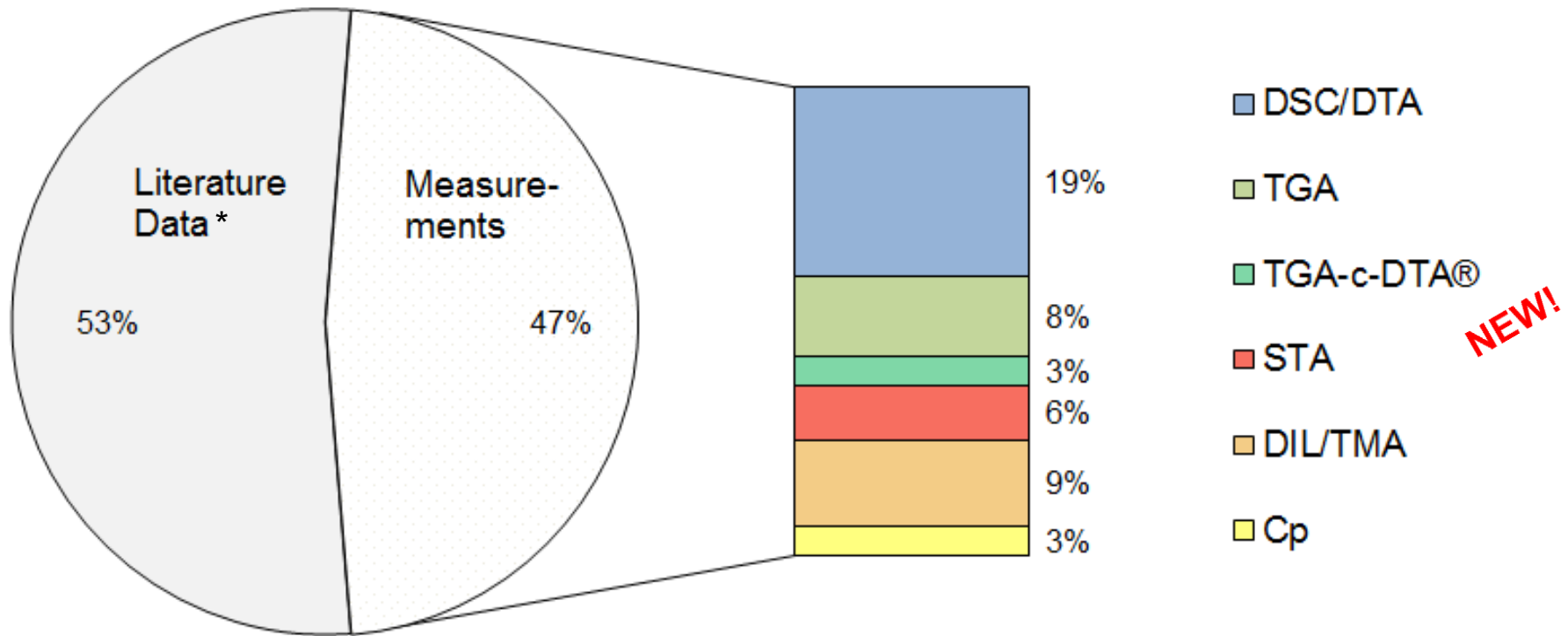
KIMW

Database entries*: **1220 NETZSCH + 800 KIMW optional**

*Expandable without limits. Such libraries can be shared with several other users at the same time in the computer network.

Identify: NETZSCH Database Contents 2018 (~1220 entries) **NETZSCH**

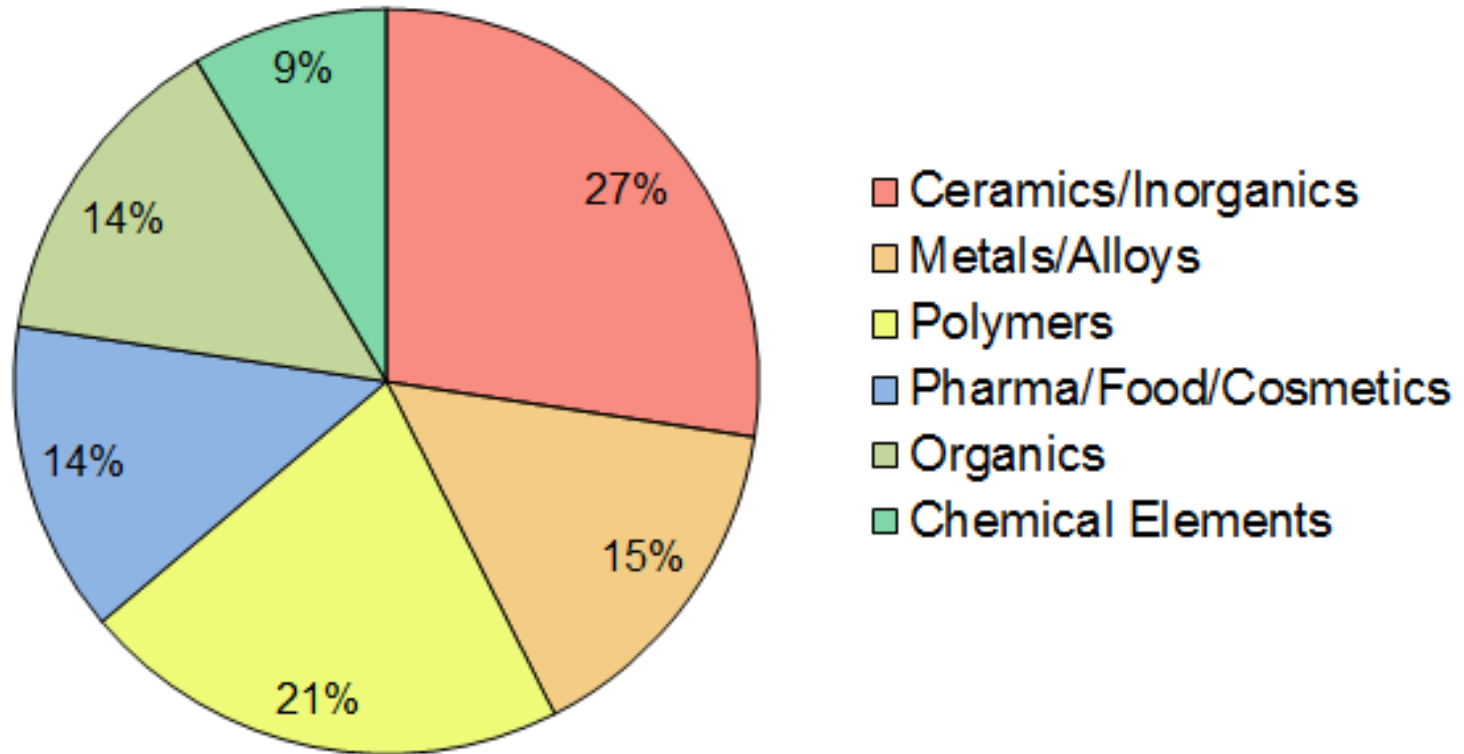
Distribution regarding measurement types:



* Most of such entries contain several properties (T_g , T_m , α , c_p , mass changes) at once!

Identify: NETZSCH Database Contents 2018 (~1220 entries) **NETZSCH**

Distribution regarding materials:



NEW!

- DSC measurements on
- NEW!** 800 commercially available polymers
- 151 polymer types.
- suppliers, trade names
- filler contents, colors



Results:

Measurement/Literature Data	Similarity [%]	Class	Similarity [%]
PA6_Akulon_F223-D_DSC	94,17	PA6	81,51
PA6_Ultramid_B3K_DSC	92,99	PBT	52,16
PA6_Domamid_A1-001-N1-N...	92,33	FEP	19,76
PA6_Aquamid_6AV_DSC	91,35	PA66	10,96
PA6_Durethan_B30S_DSC	90,94	PET	6,74
PBT_Celanex_2300_GV1-10...	81,30	ETFE	3,39
PBT_Crastin_S620_F20_DSC	73,96	LCP	1,00
PA6_vernetzt_Betalink_Mast...	71,40	PP	0,19
		TPU	0,06

Search Libraries:

Library	Entries	
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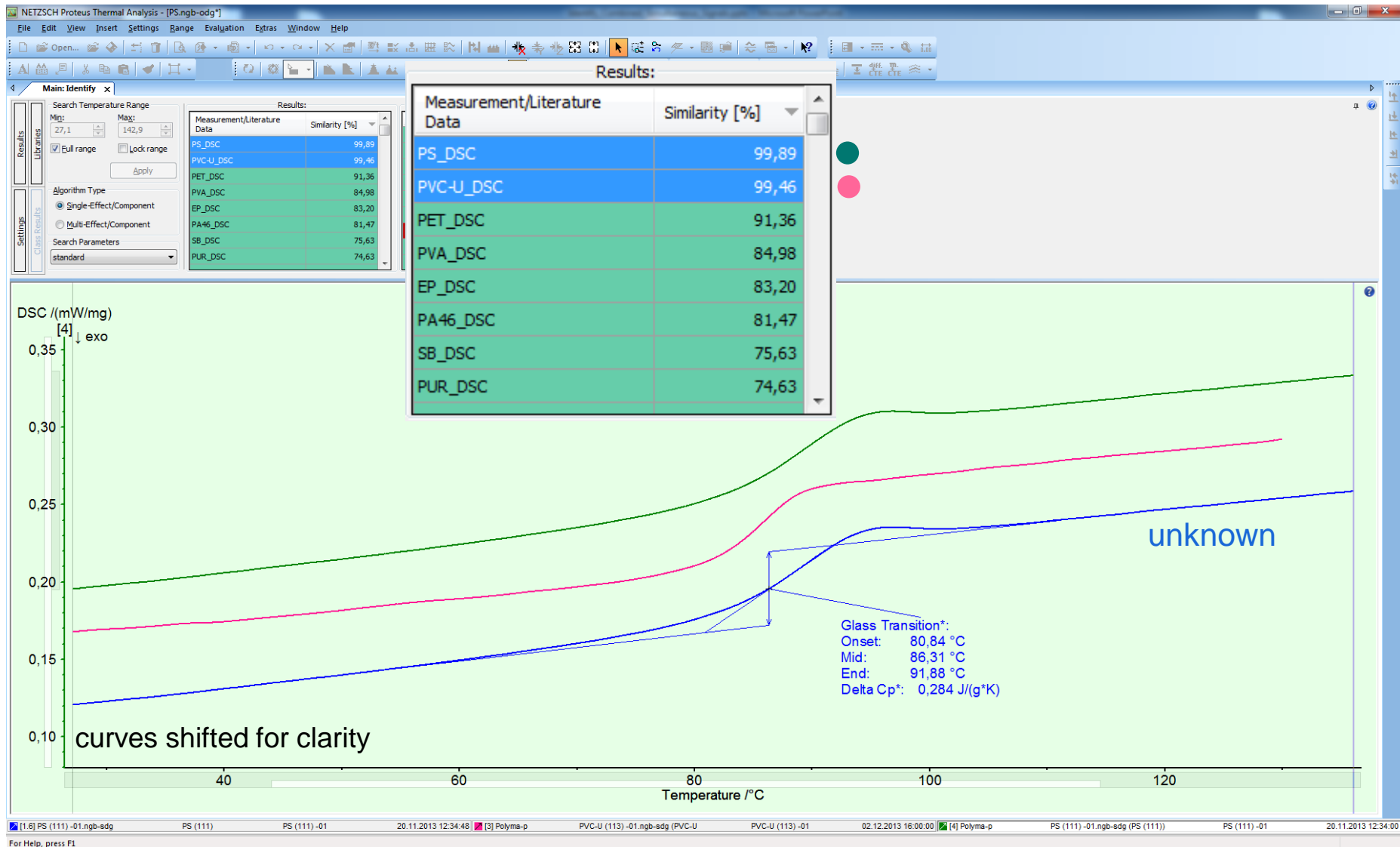
02

Combined and Simultaneous
Signals

Problem: Multiple Interpretations of DSC Signals

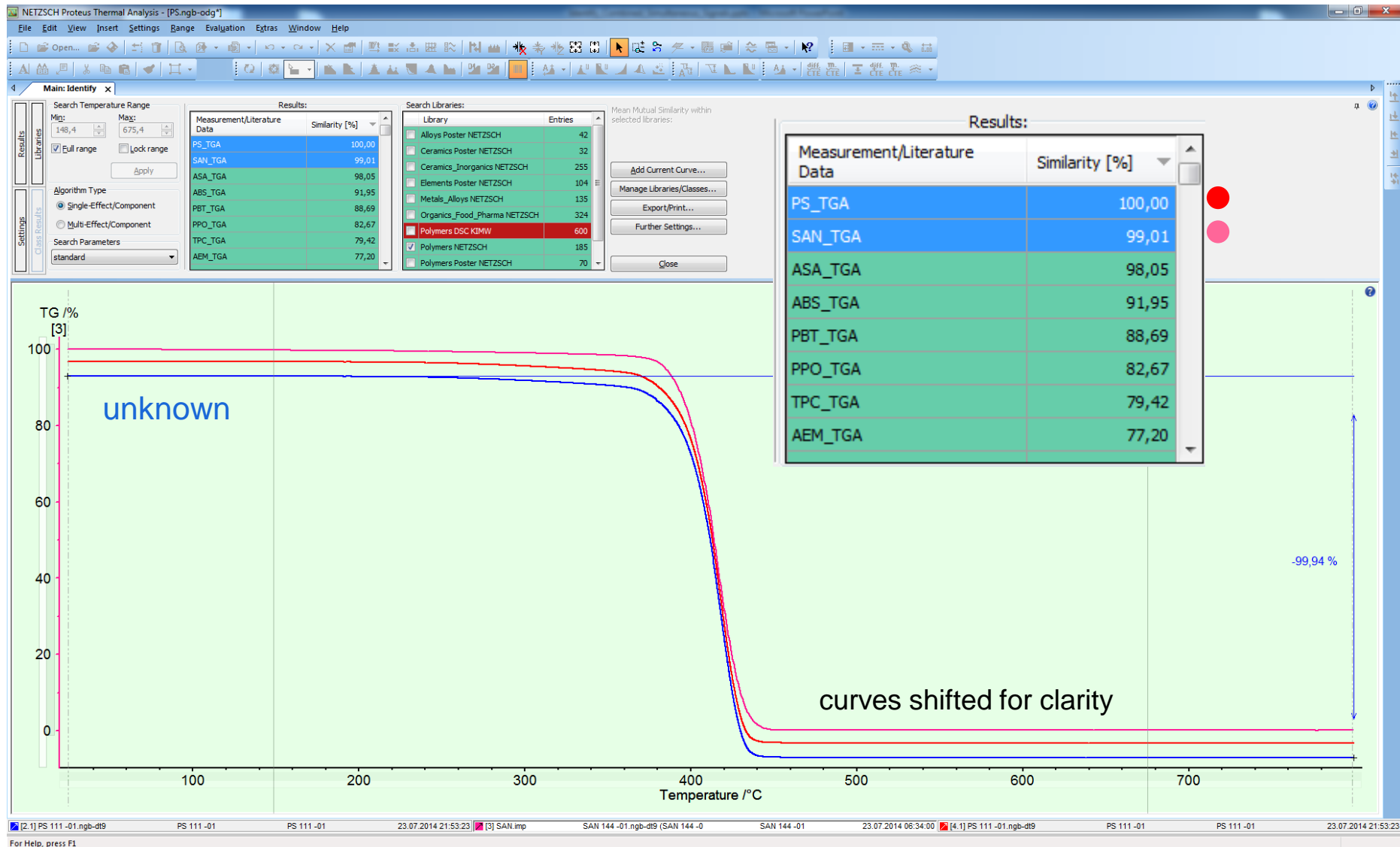
Example: We can unfortunately not distinguish PS from PVC-U via DSC

NETZSCH



Problem: Multiple Interpretations of TGA Signals

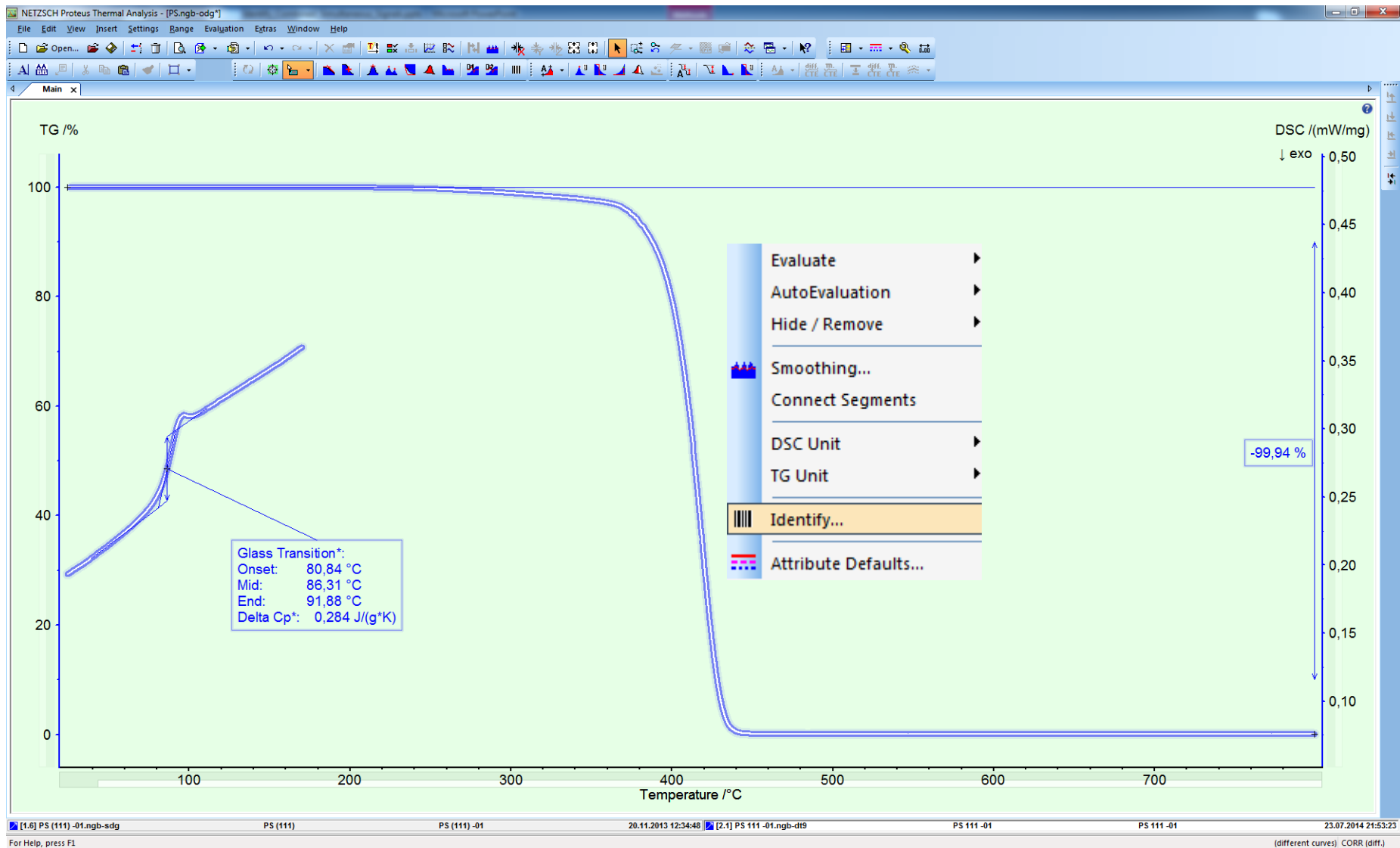
Example: And we can unfortunately also not distinguish PS from SAN via TGA



Solution: Combine (independent!) DSC and TGA signals

Select DSC+TGA with Ctr-button and left mouse and call *Identify* (right mouse button)

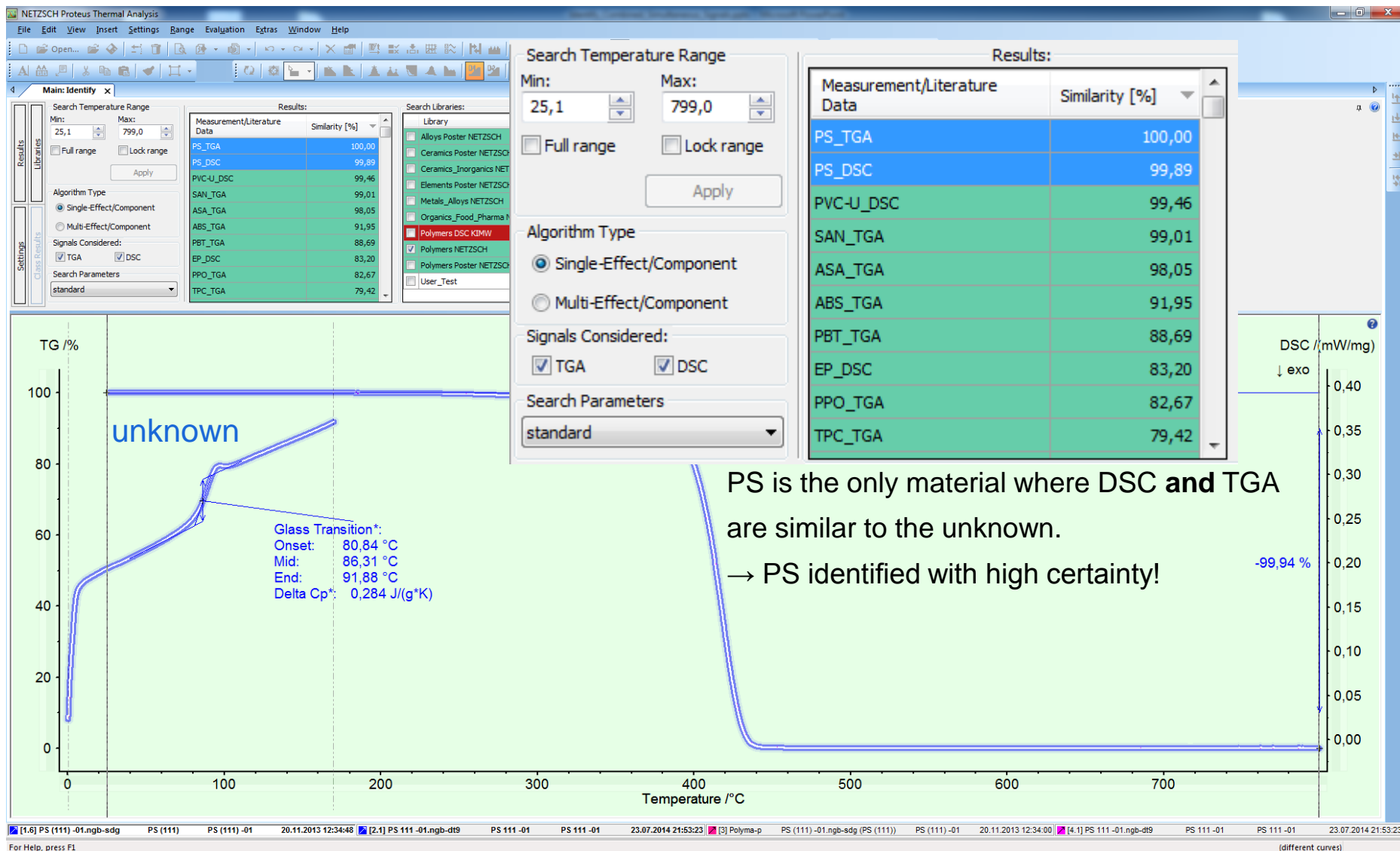
NETZSCH



Solution: Combine (independent!) DSC and TGA

In *Identify*, search for TGA+DSC in combination, or consider either TGA or DSC

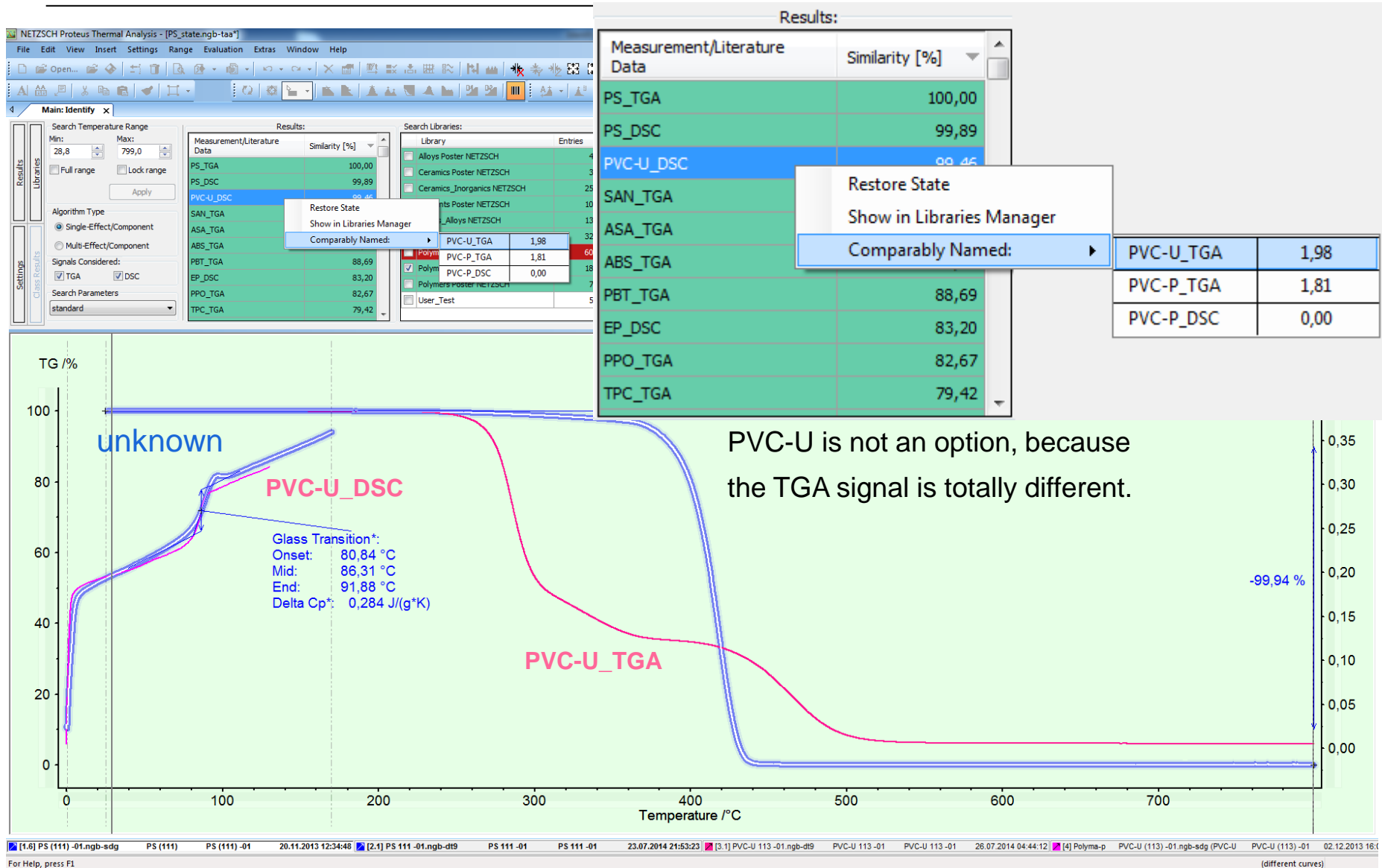
NETZSCH



Solution: Combine (independent!) DSC and TGA

In *Identify*, search for TGA+DSC in combination, or consider either TGA or DSC

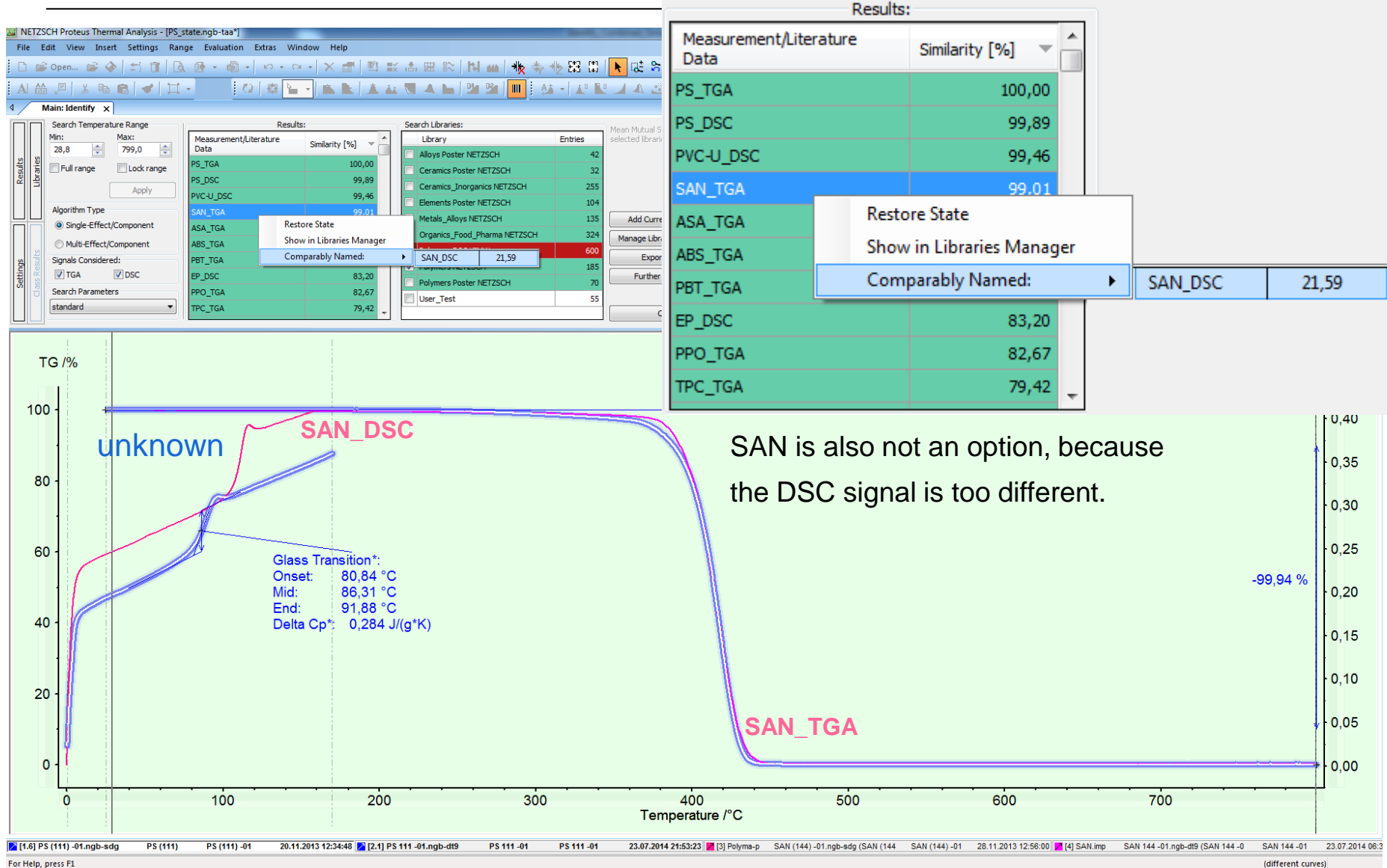
NETZSCH



Solution: Combine (independent!) DSC and TGA

In *Identify*, search for TGA+DSC in combination, or consider either TGA or DSC

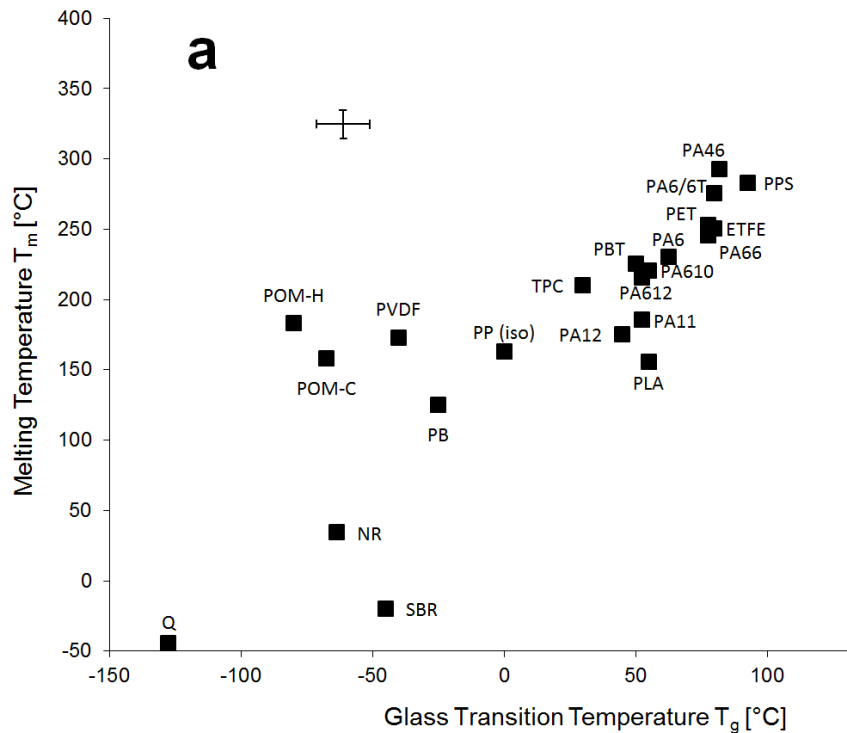
NETZSCH



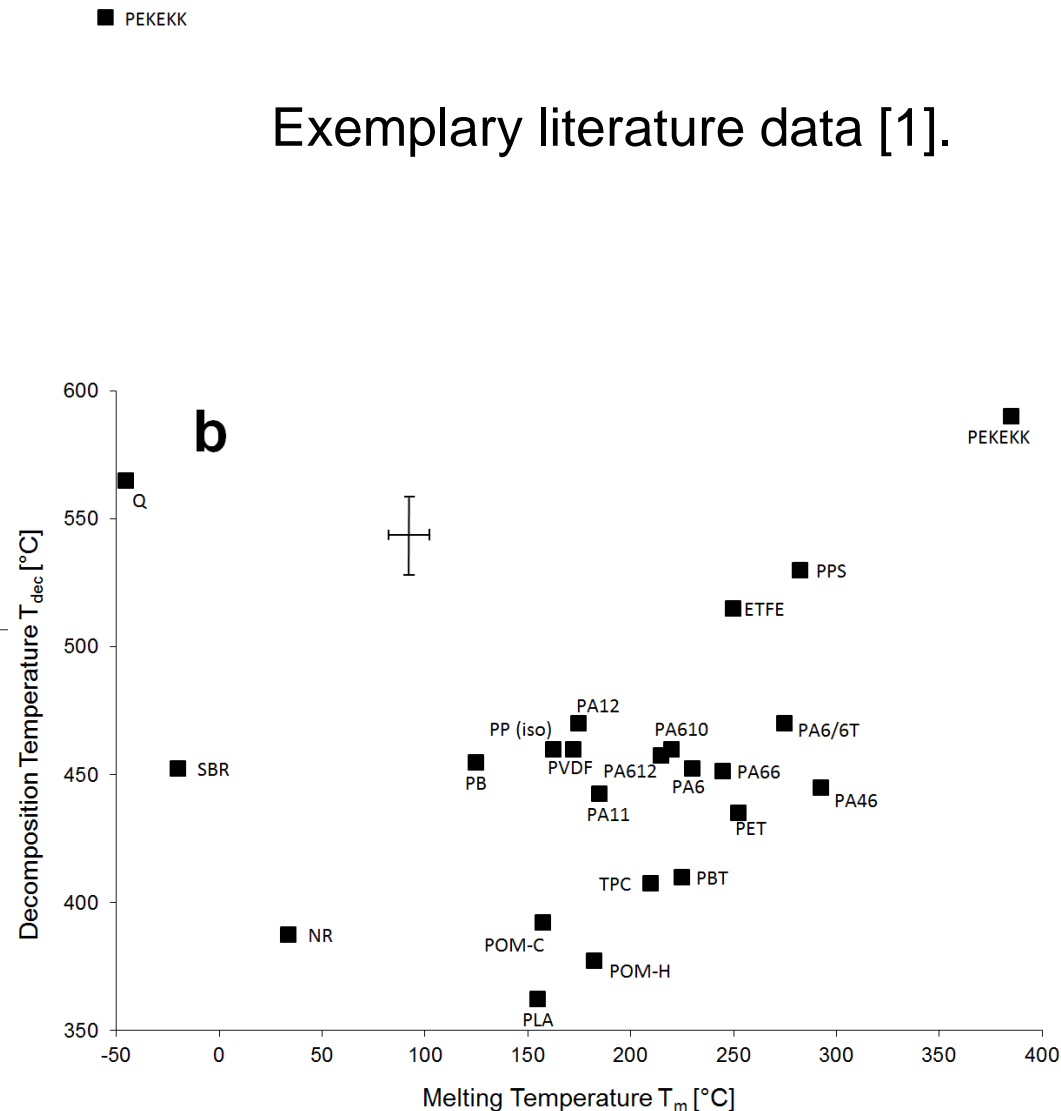
SAN is also not an option, because the DSC signal is too different.

Let's have a look at further cases

Consideration of DSC *and* TGA will in many cases improve the situation of multiple interpretations!



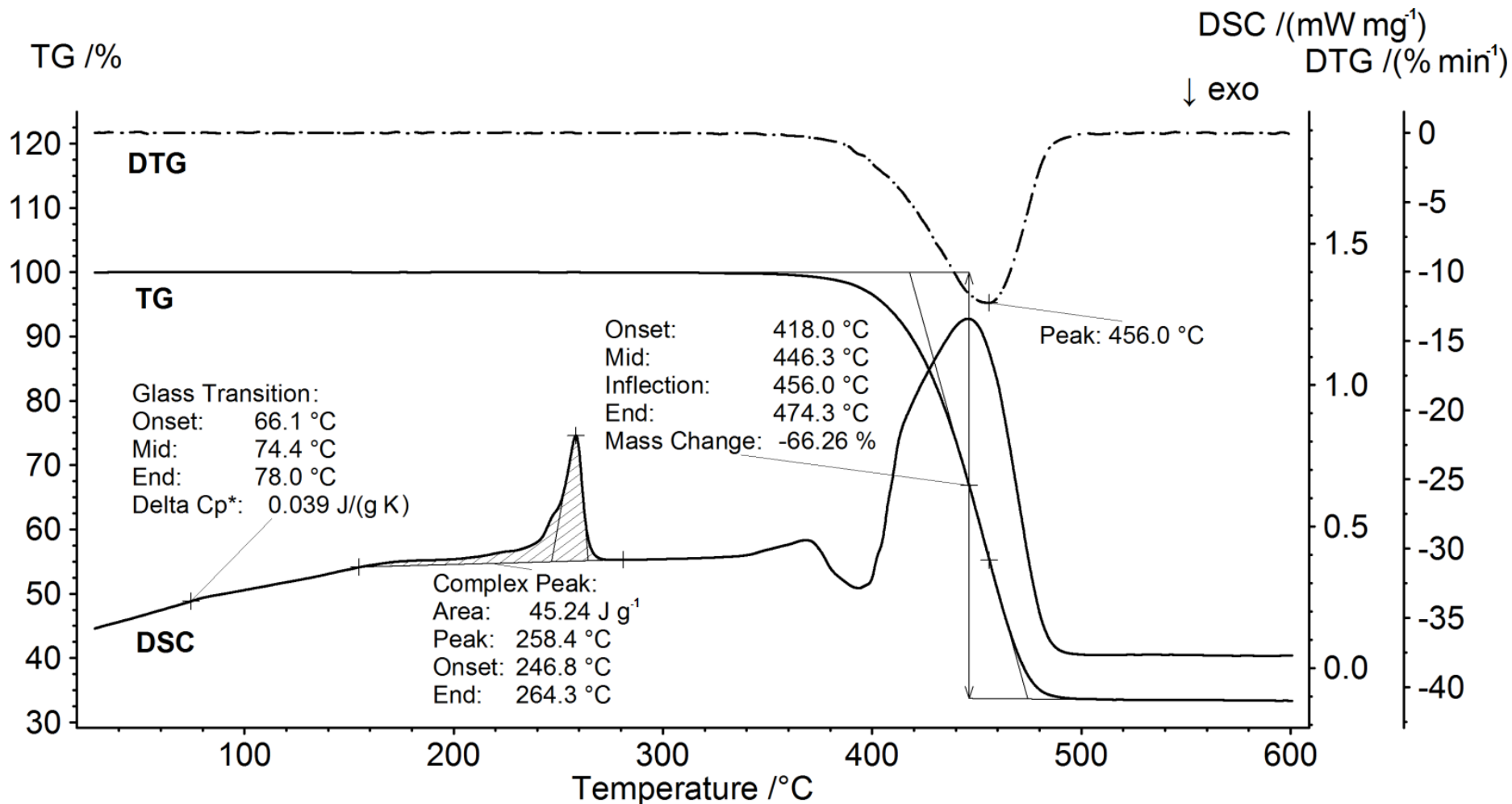
[1] A.Schindler et al., Identification of polymers by means of DSC, TG, STA and computer-assisted database search. J. Therm. Anal. Calorim., [DOI 10.1007/s10973-017-6208-5](https://doi.org/10.1007/s10973-017-6208-5)



STA measurement on "PA66-GF30_STA" (see ref. [1])

STA 449 *F3 Jupiter*®, steel furnace.

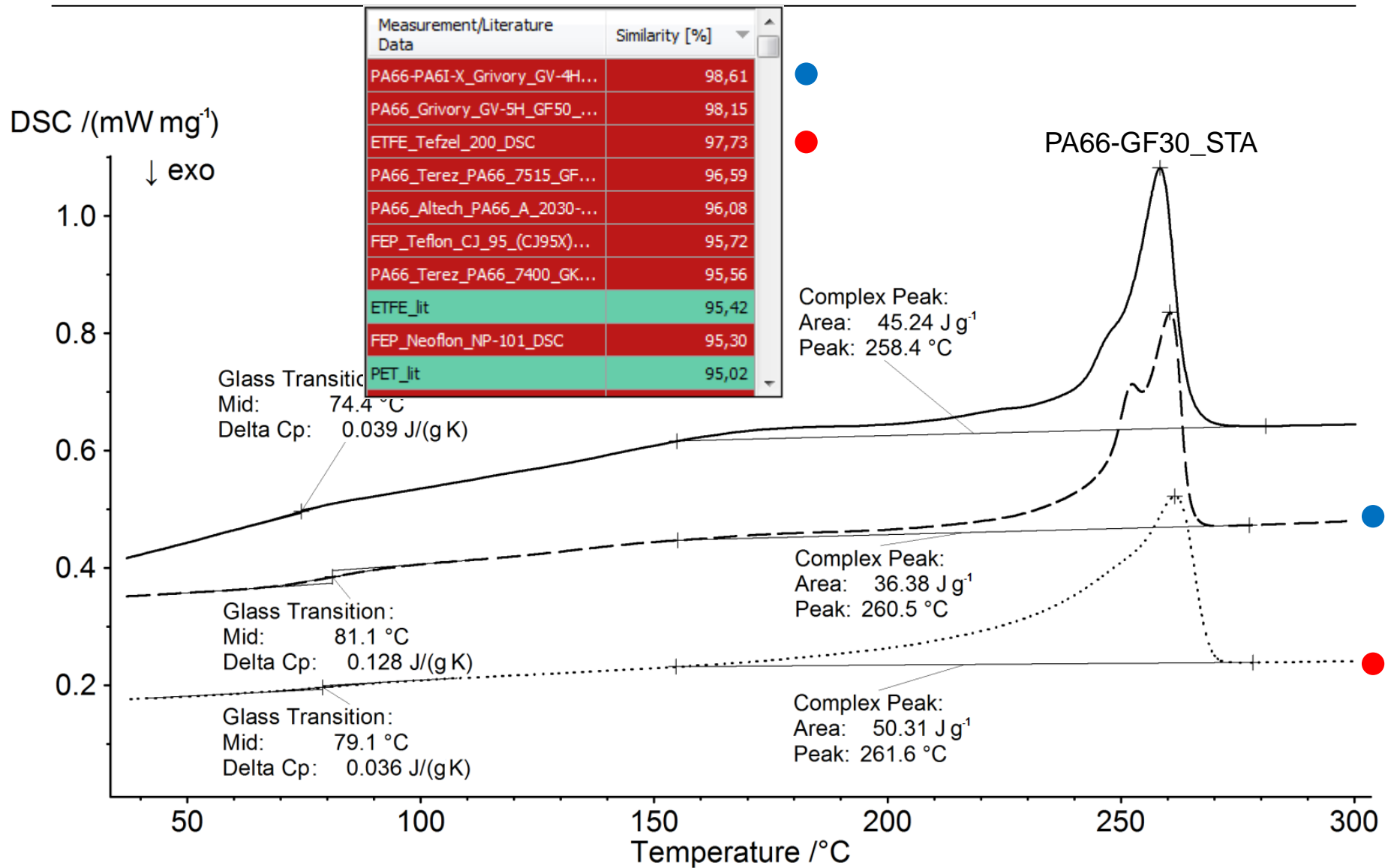
NETZSCH



Identify on "PA66-GF30_STA" (see ref. [1])

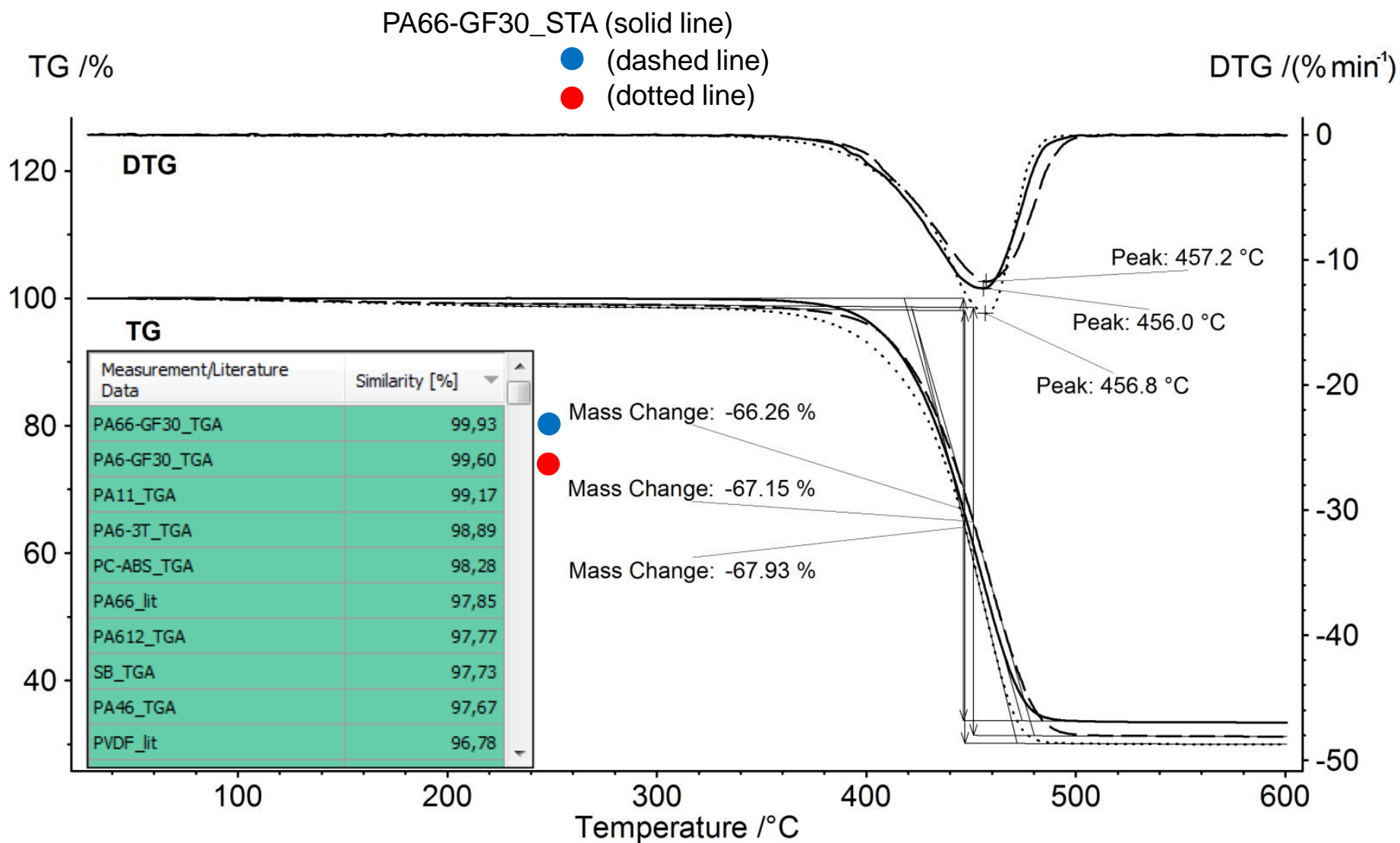
Just considering the DSC signal → No definite identification!

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Identify on "PA66-GF30_STA" (see ref. [1])

Just considering the TGA signal → Again no definite identification!



Identify on “PA66-GF30_STA” (see ref. [1])

Take both: DSC *and* TGA signal → Much better identification!

In this example, PA66 is the only material with a high similarity regarding, both, DSC and TGA.

This can most easily be seen when only the library „NETZSCH Polymer Poster“ is selected. These database entries contain DSC *and* TGA properties that are considered in combination!

→ PA66 is best hit, other materials are discriminated.

Measurement/Literature Data	Similarity [%]
PA66_lit	94,29
PA6-6T_lit	87,84
PET_lit	86,92
ETFE_lit	75,87
FEP_lit	72,04
(HBA, HNA)-LCP_lit	64,84
EP_lit	64,79
PF_lit	62,61
PA6_lit	59,44
PVAL_lit	58,71

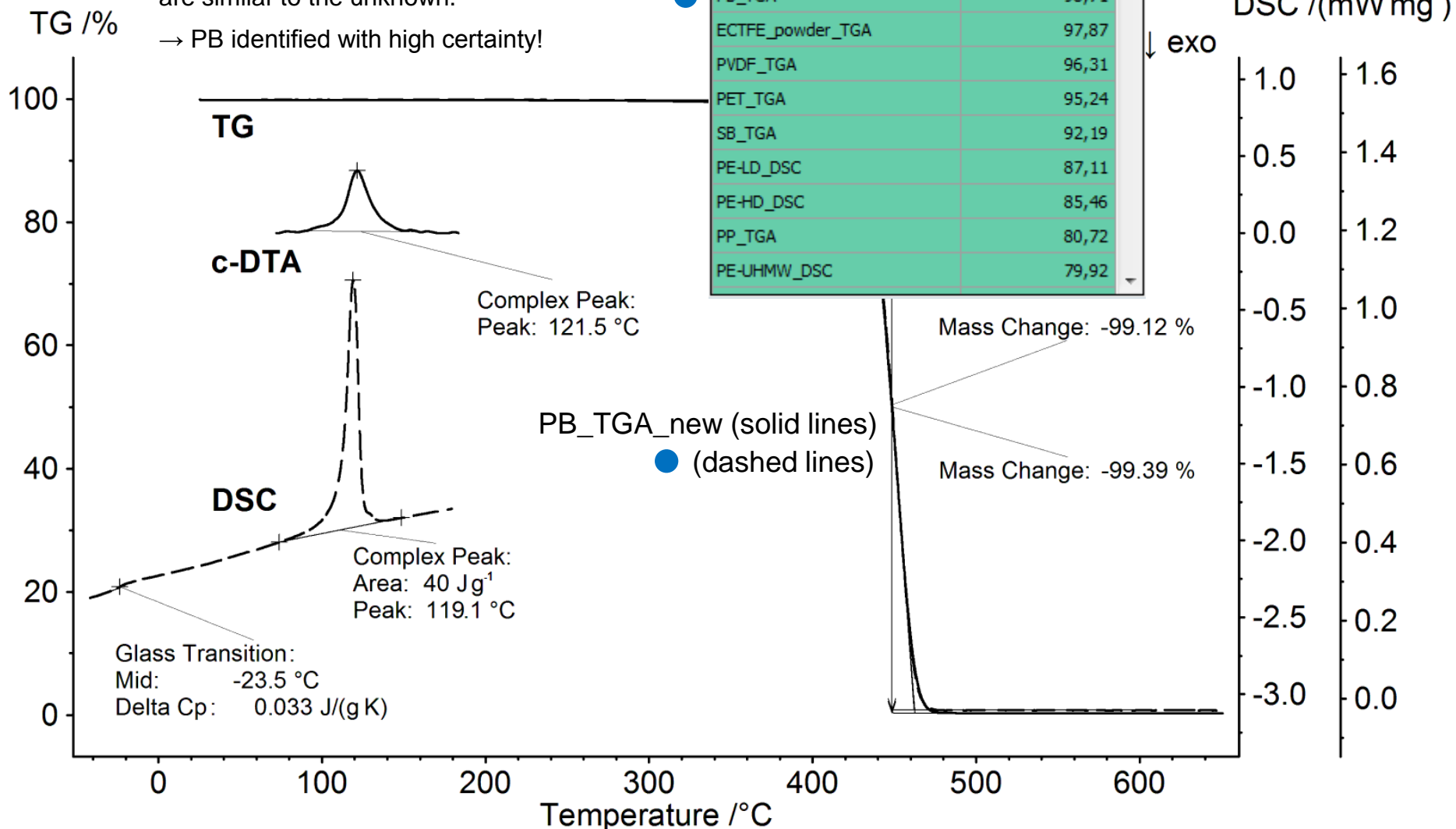
TGA measurement on "PB_TGA_new" (see ref. [1])

TG 209 *F1 Libra*®. *Identify* can consider TGA+c-DTA®

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PB is the only material where DSC and TGA are similar to the unknown.

→ PB identified with high certainty!

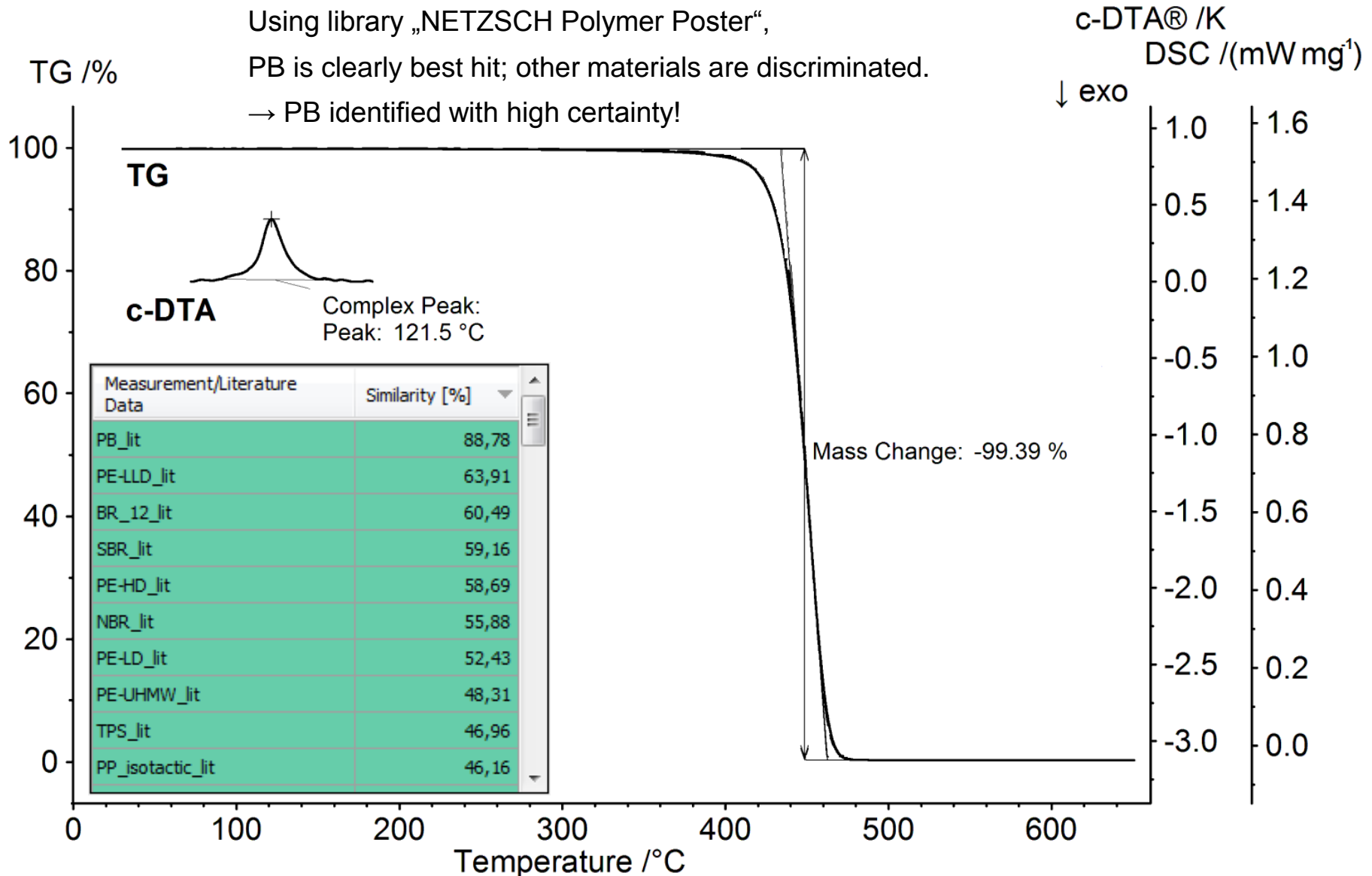


TGA measurement on "PB_TGA_new" (see ref. [1])

TG 209 F1 Libra®. Identify can consider TGA+c-DTA®

NETZSCH

Using library „NETZSCH Polymer Poster“,
PB is clearly best hit; other materials are discriminated.
→ PB identified with high certainty!



c-DTA[®] is the linkage between the TGA and DSC worlds

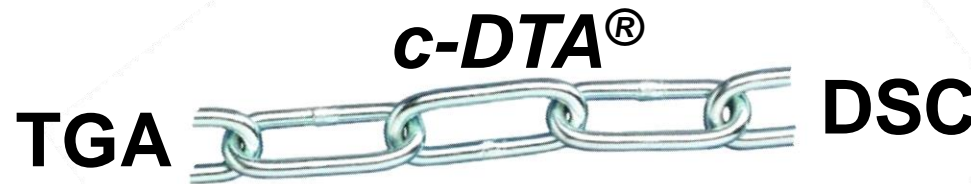
Identify features this linkage!

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TGA-c-DTA[®] → TGA(-c-DTA[®]) but also DSC and STA are found by *Identify*

DSC → DSC but also TGA-c-DTA[®] and STA are found by *Identify*

STA → STA, DSC, TGA, TGA-c-DTA[®] are found by *Identify*



Overview

Which signals (A vs. B) can be found by *Identify*? Status 2018 (*Proteus*® 8.0):

A \ B	DSC	TGA	STA	TGA- <i>c</i> -DTA®	DIL	TMA	C _p
DSC	✓		✓	✓			
TGA		✓	✓	✓			
STA	✓	✓	✓✓	✓✓			
TGA- <i>c</i> -DTA®	✓	✓	✓✓	✓✓			
DIL					✓	✓	
TMA					✓	✓	
C _p							✓

Remarks:

- A, B: measurements or literature data („unknown“ is always a measurement).
- DSC can also be DTA.
- ✓✓: two signal types can be identified in combination - or just one of the signal types.

- More than 2000 db entries are available!
- *Identify* can now incorporate:
Combined signals (TGA+DSC indep. and TGA-*c*-DTA[®])
Simultaneous signals (TGA+DSC = STA)
- This makes material identification more definite!
- The contents of this presentation is published:
A.Schindler et al., Identification of polymers by means of DSC, TG, STA and computer-assisted database search, J. Therm. Anal. Calorim., [DOI 10.1007/s10973-017-6208-5](https://doi.org/10.1007/s10973-017-6208-5)