

Bavarian Center for Applied Energy Research

Round Robin Test Thermal Conductivity / Diffusivity

M. Brütting

IEA Task 4229 – DSC Workshop 4 - 5 April 2016

MIT SONNE UND VERSTAND.

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Outline

1. Participants
2. Sample Preparation
3. Results
4. Next steps?

Round Robin Test – Thermal Conductivity / Diffusivity

Participants



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- Austrian Institute of Technology
- Fraunhofer Institute for Solar Energy Systems ISE
- Université d'Artois
- University of Bayreuth
- University of Zaragoza
- Bavarian Center for Applied Energy Research (ZAE Bayern)
- Université Paris Est Créteil

Round Robin Test – Thermal Conductivity / Diffusivity Instrumentation



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Thermal Diffusivity

- Netzsch LFA 427
- Netzsch LFA 447
- Netzsch LFA 457
- Netzsch LFA 467
- DICO

Thermal Conductivity

- Hot Wire (self-built)
- Transient Hot Bridge (Linseis)
- Heat flux meter setup (self-built)
- Hot Disk Sensor
- DICO

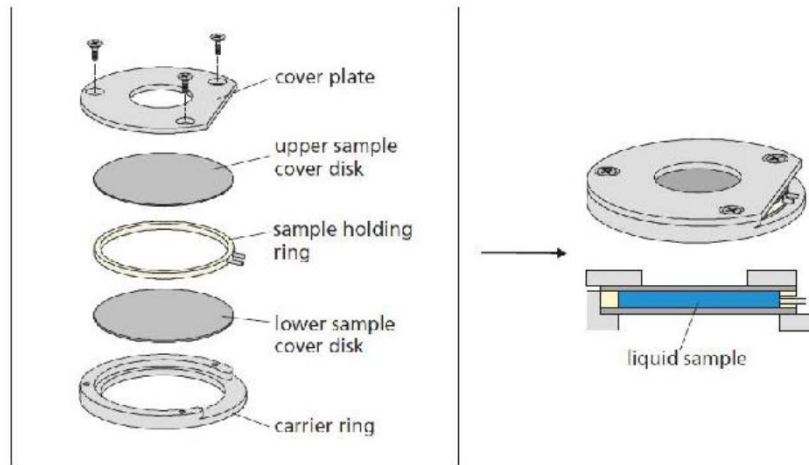
Round Robin Test – Thermal Conductivity / Diffusivity Sample Preparation



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PEEK sample holder for liquids



Round Robin Test – Thermal Conductivity / Diffusivity

Sample Preparation



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Aluminum sample holder for liquids



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Sample Preparation



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Solid pills



Preparation in sample holder for liquids



Gold coating



Graphite coating



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Sample Preparation

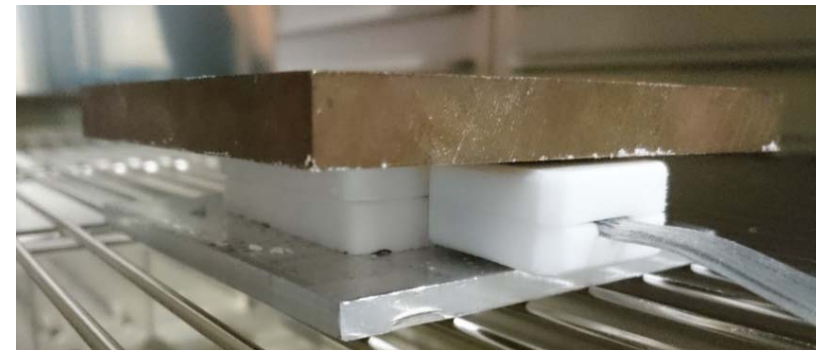


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Hot Wire

Transient Hot Bridge



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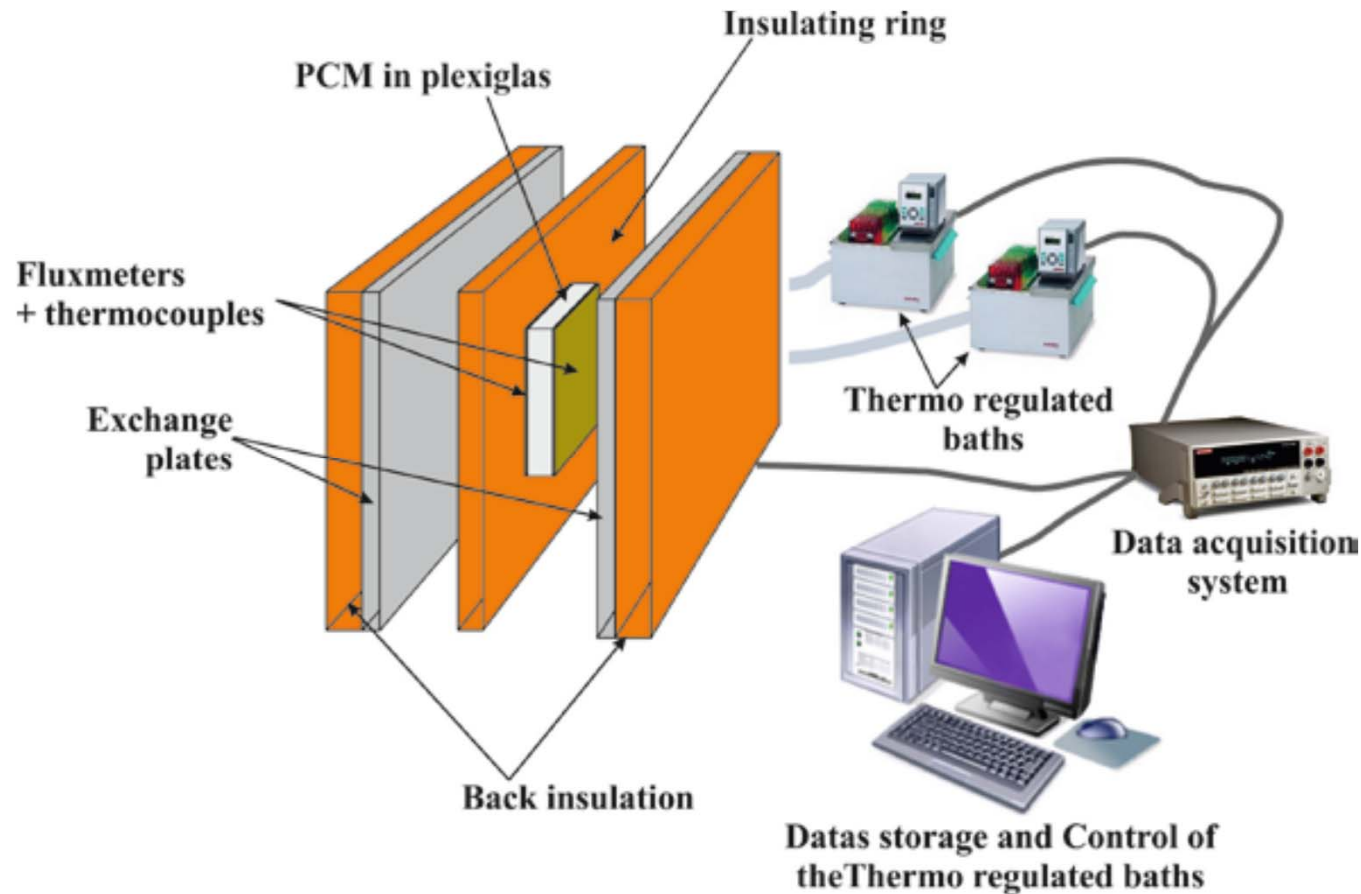
Sample Preparation



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Flux metric setup

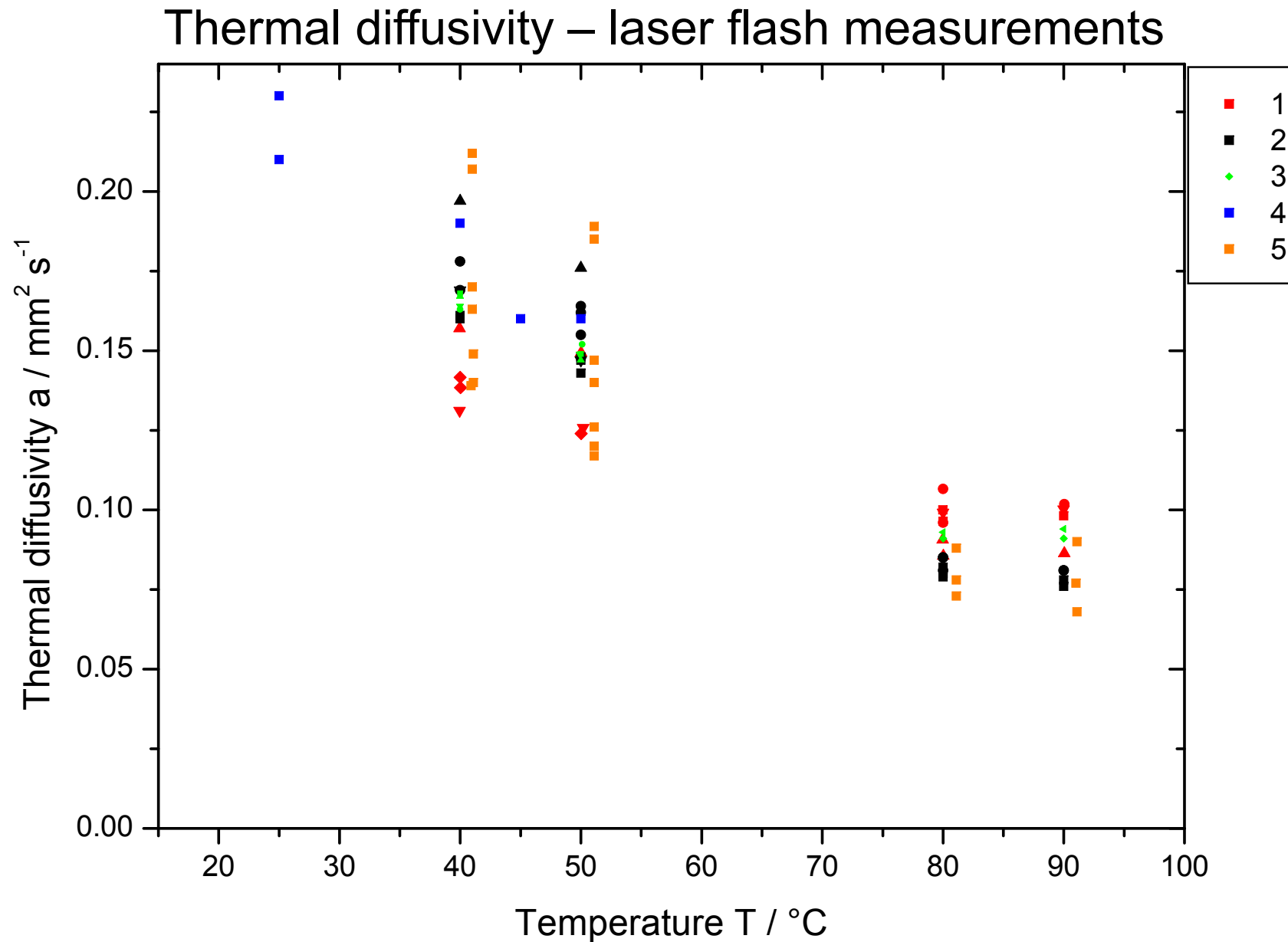


Round Robin Test – Thermal Conductivity / Diffusivity Results



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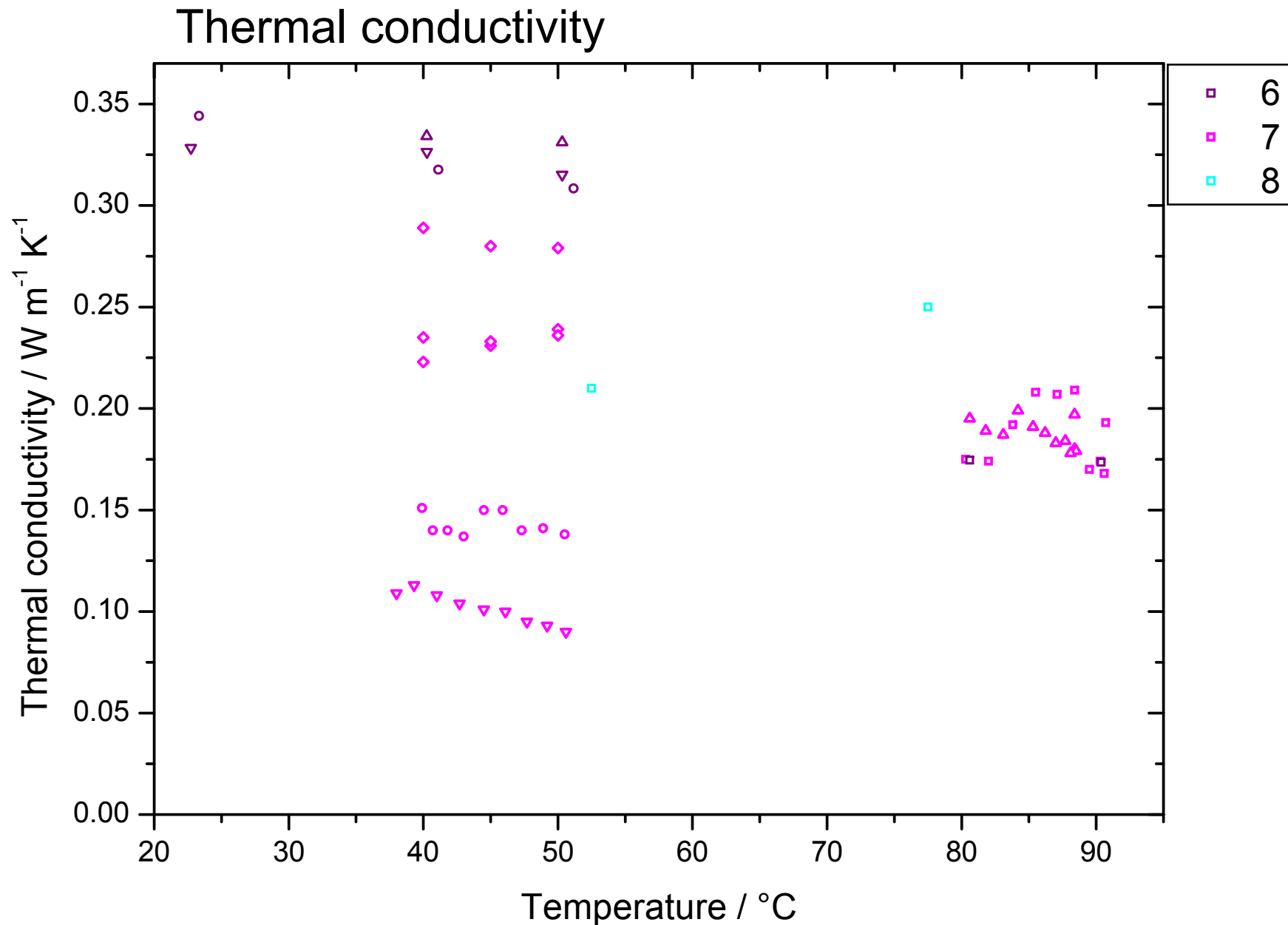


Round Robin Test – Thermal Conductivity / Diffusivity Results



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Round Robin Test – Thermal Conductivity / Diffusivity Results



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Thermal diffusivity / conductivity (converted)

$$a = \frac{\lambda}{\rho \cdot c_p}$$

Manufacturers values

DSC values

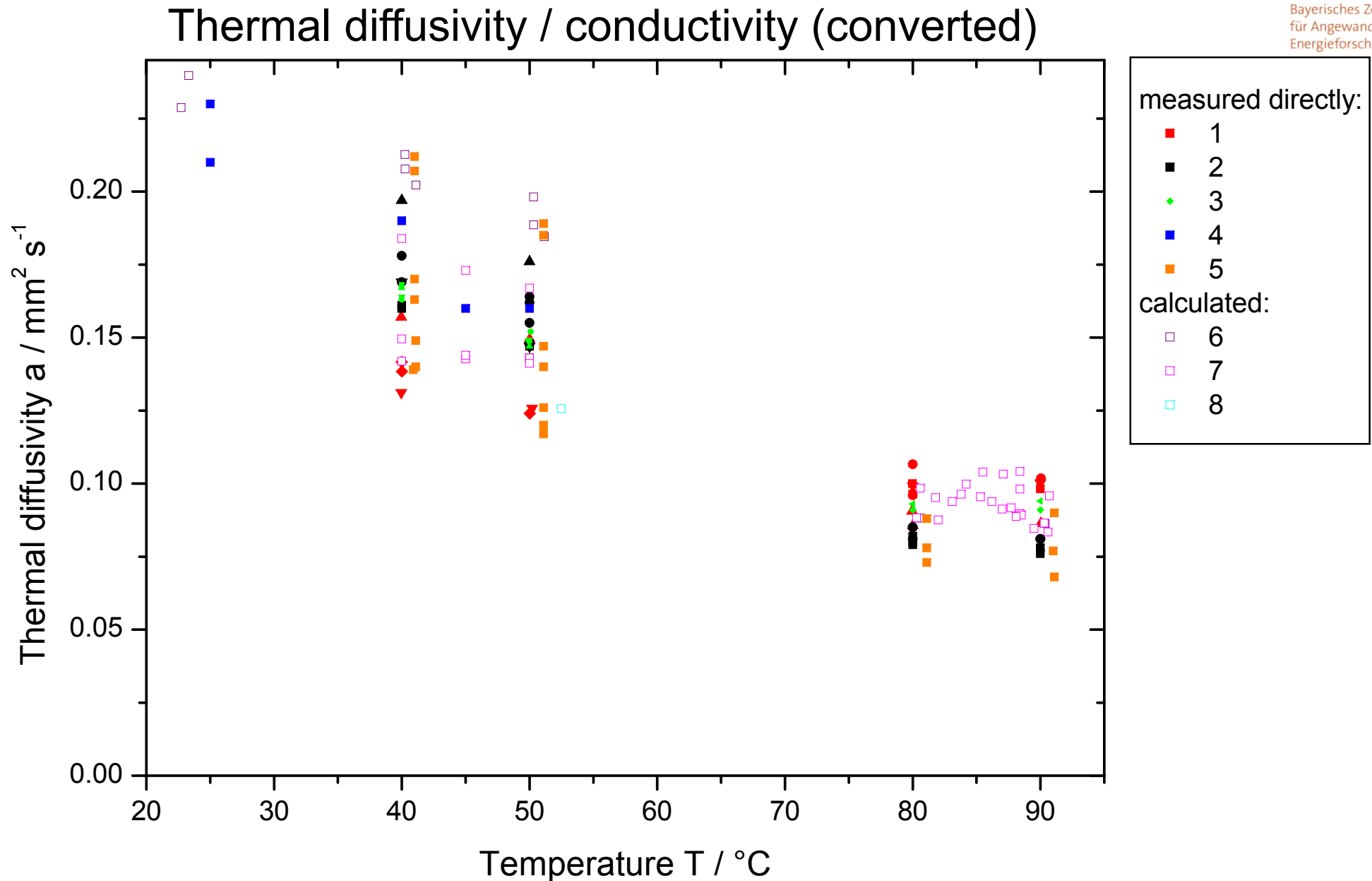
	ρ kg / m ³
solid	880
liquid	770

T °C	c_p J / g K
40	1.79
50	1.90
80	2.57
90	2.61

Round Robin Test – Thermal Conductivity / Diffusivity Results



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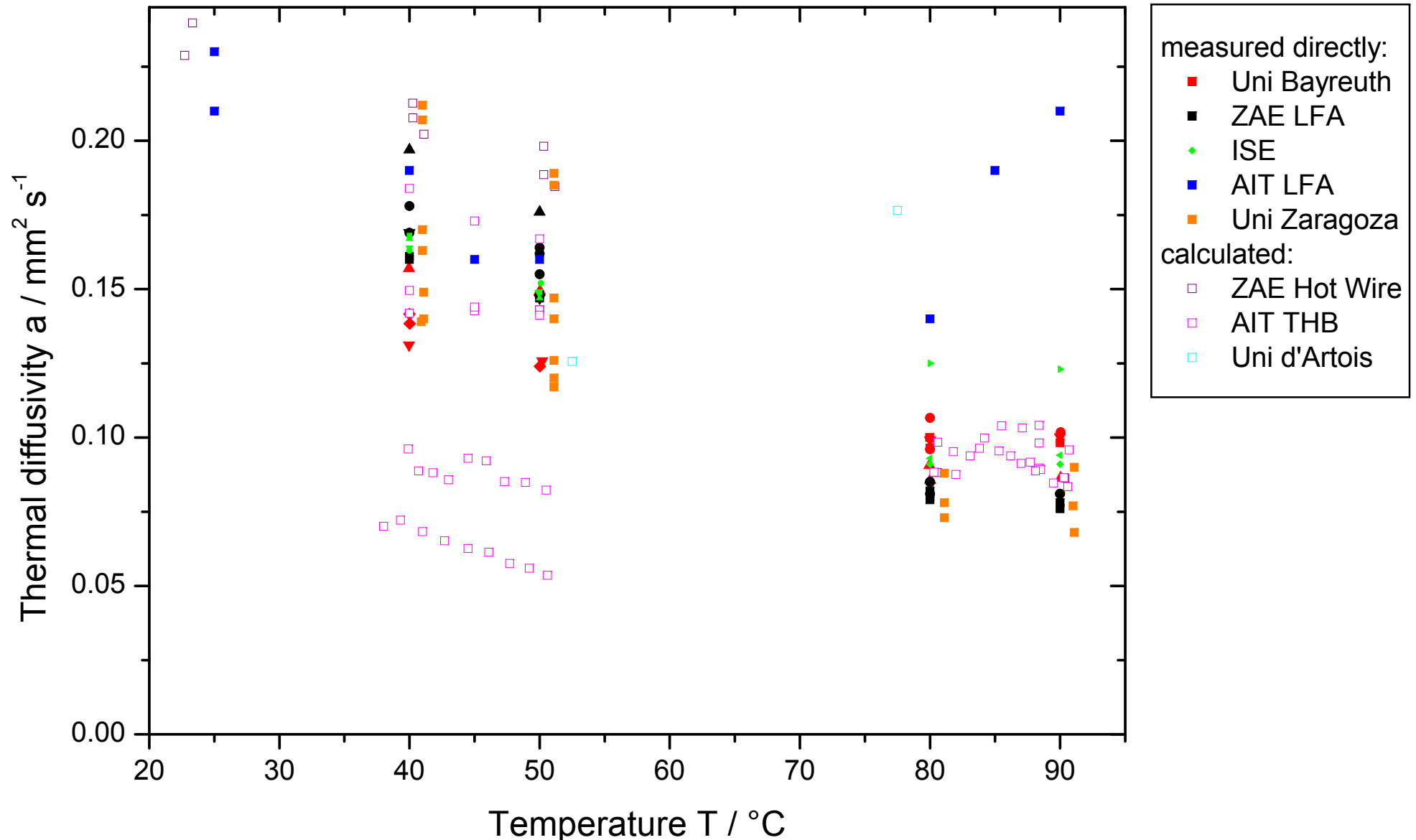


Round Robin Test – Thermal Conductivity / Diffusivity Results



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Thermal diffusivity / conductivity (converted)

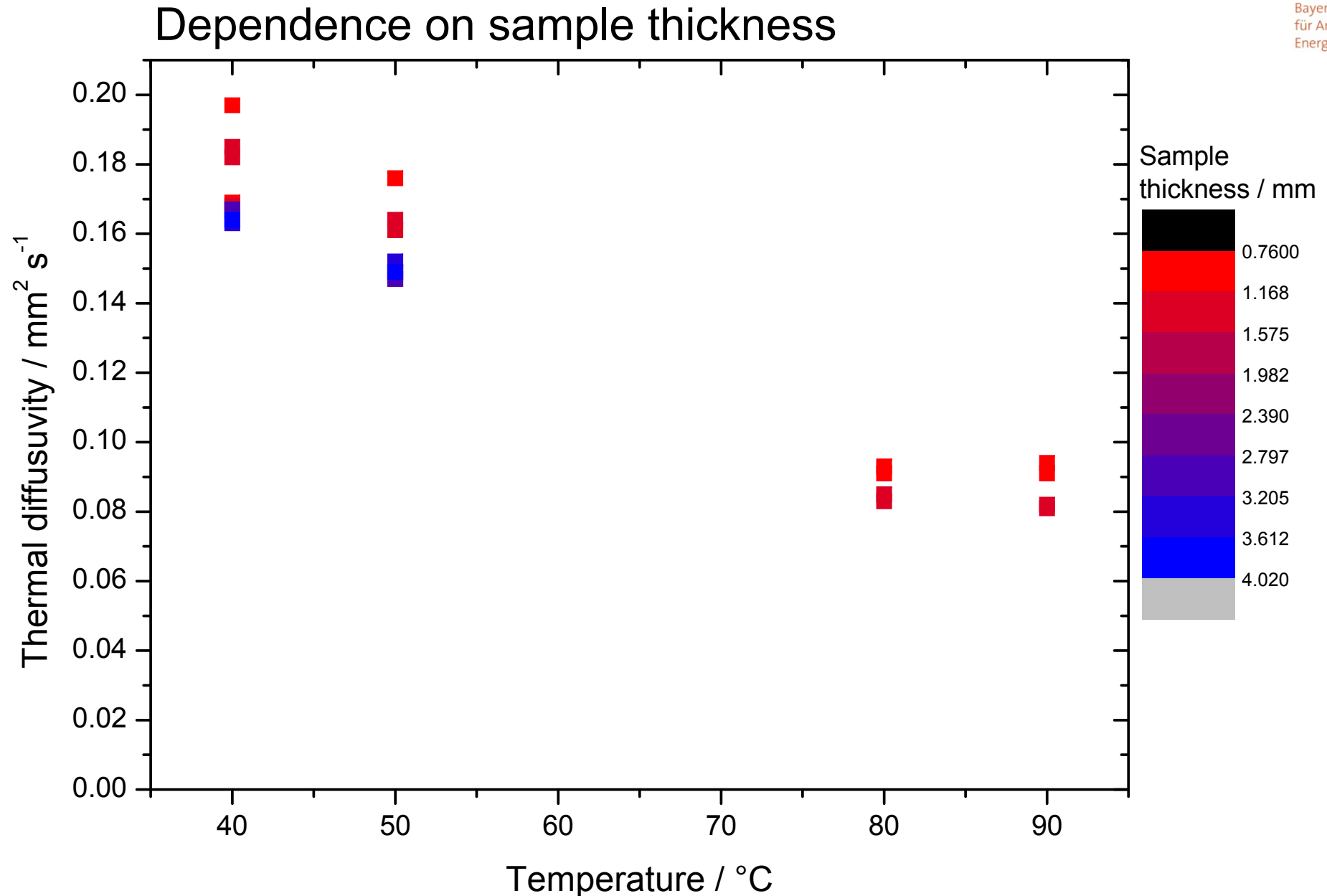


Round Robin Test – Thermal Conductivity / Diffusivity Results



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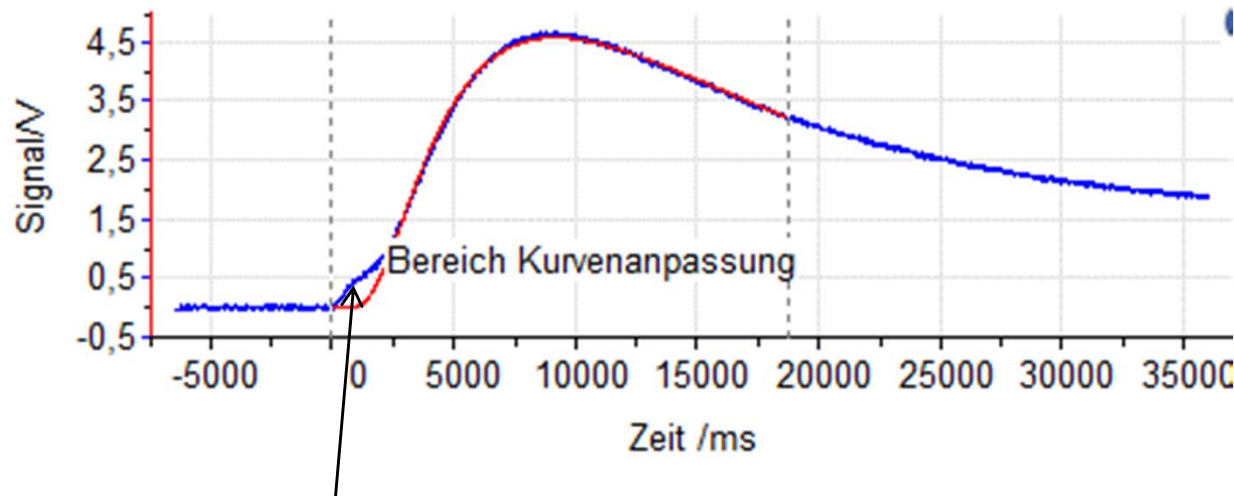
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Curve fitting of LFA signal



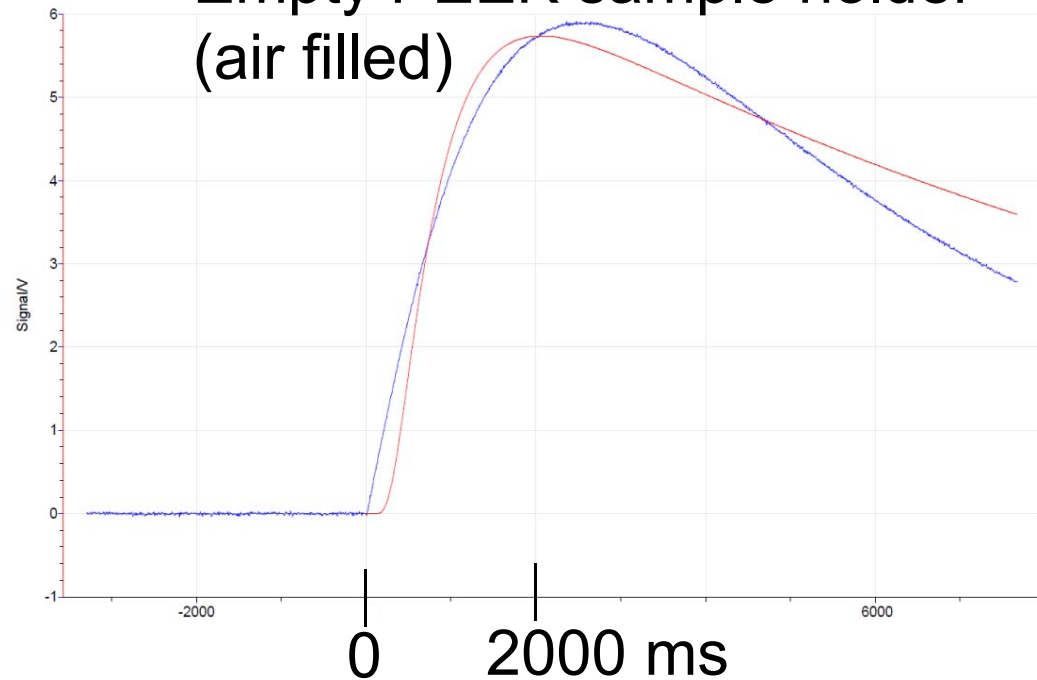
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Small peak at the beginning
Of the measurement

Empty PEEK sample holder
(air filled)



Round Robin Test – Thermal Conductivity / Diffusivity

Next steps?



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Possible reasons for deviations

- Dependence on thickness
- Dependence on pulse energy
- Influence of the sample holder
- Determination of sample thickness

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