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Thermophysical Properties Measurements at Temperatures up to 2800°C using the Flash Technique

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Overview

- Thermophysical Properties Testing at very High Temperatures
  - Some possible Applications
  - Explanation of the Laser Flash Method

- Laser Flash at High Temperatures
  - Technical Design of the High Temperature Laser Flash System
  - Test Results and Applications

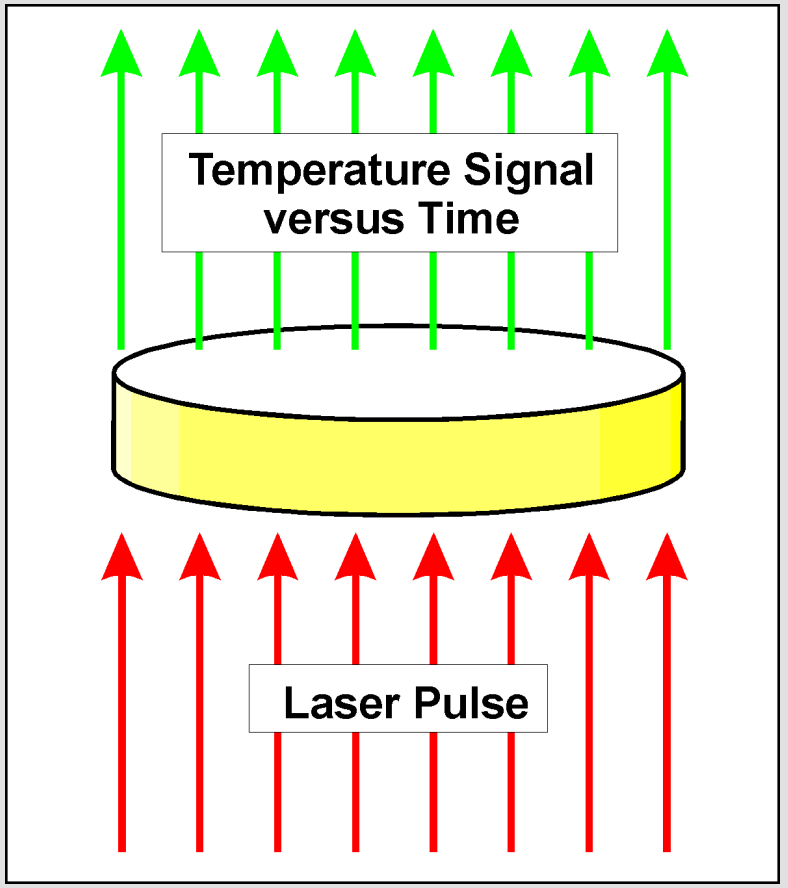
- Summary

Explanation of the LFA Method

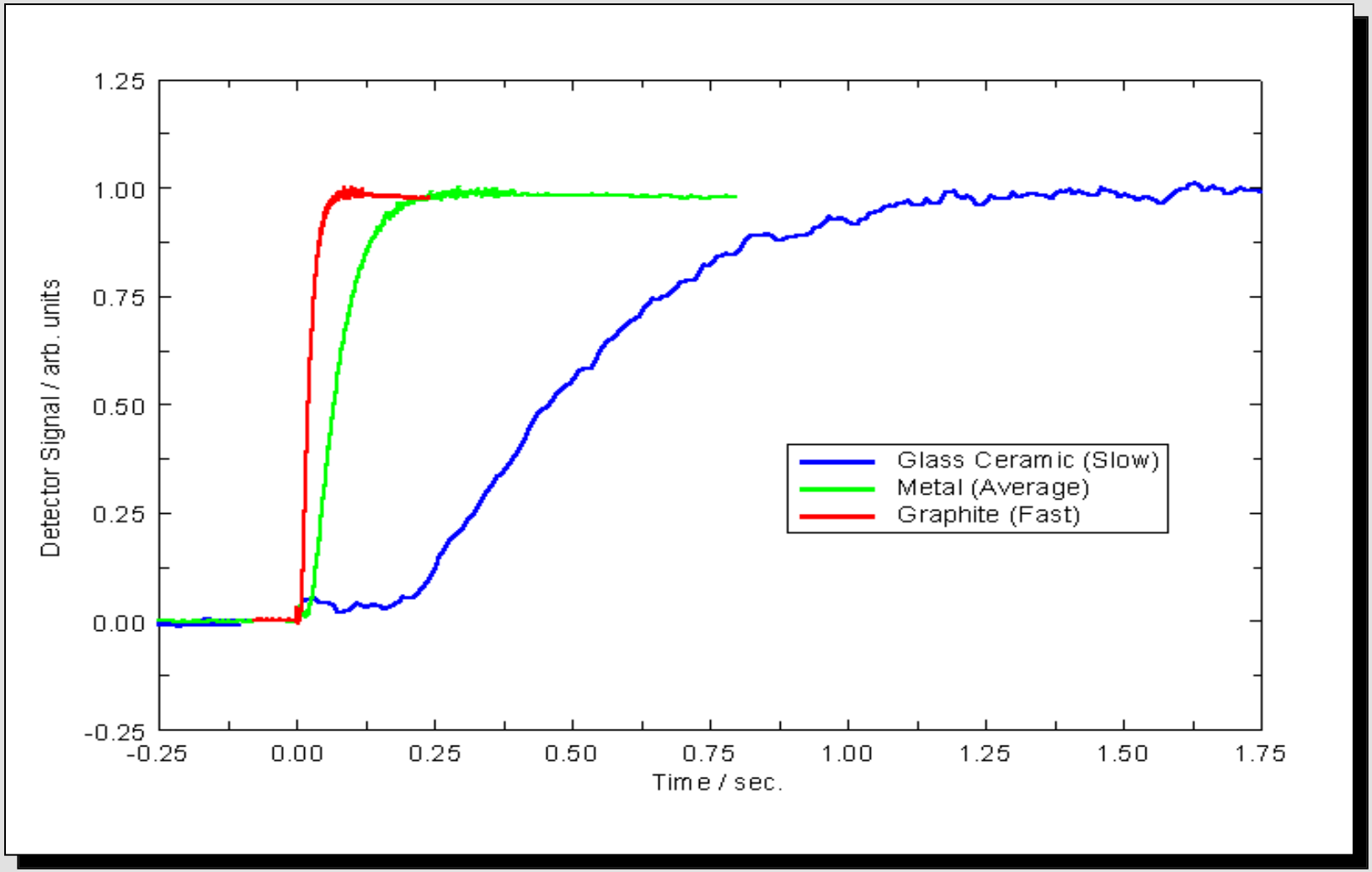
Flash Method:
Measurement Principle
Introduced by Parker et al. 1961

The front surface of a plan-parallel sample is heated by a short light or laser pulse.

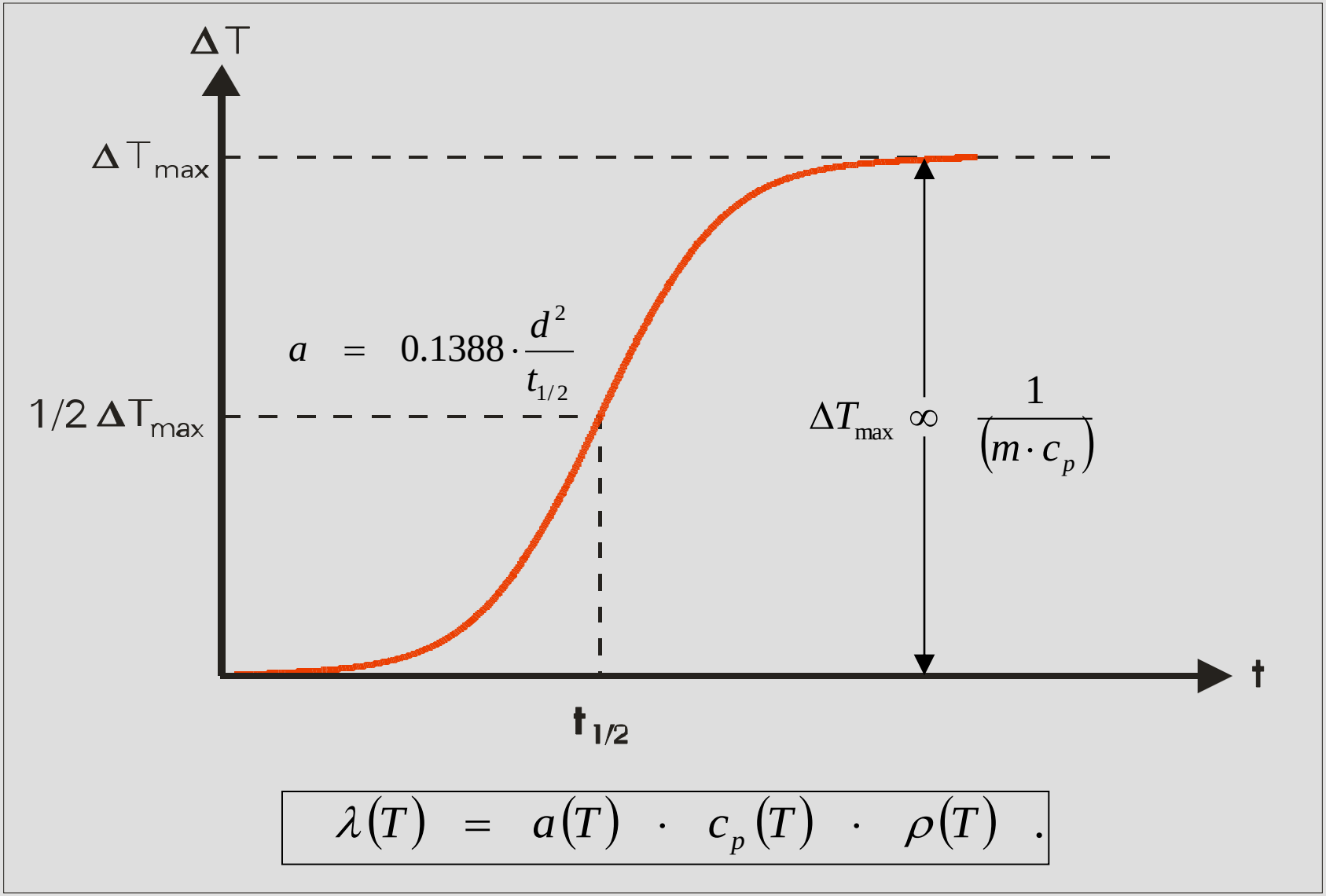
The temperature rise on the rear surface is measured versus time using an IR detector.



Detector Curves for Different Materials

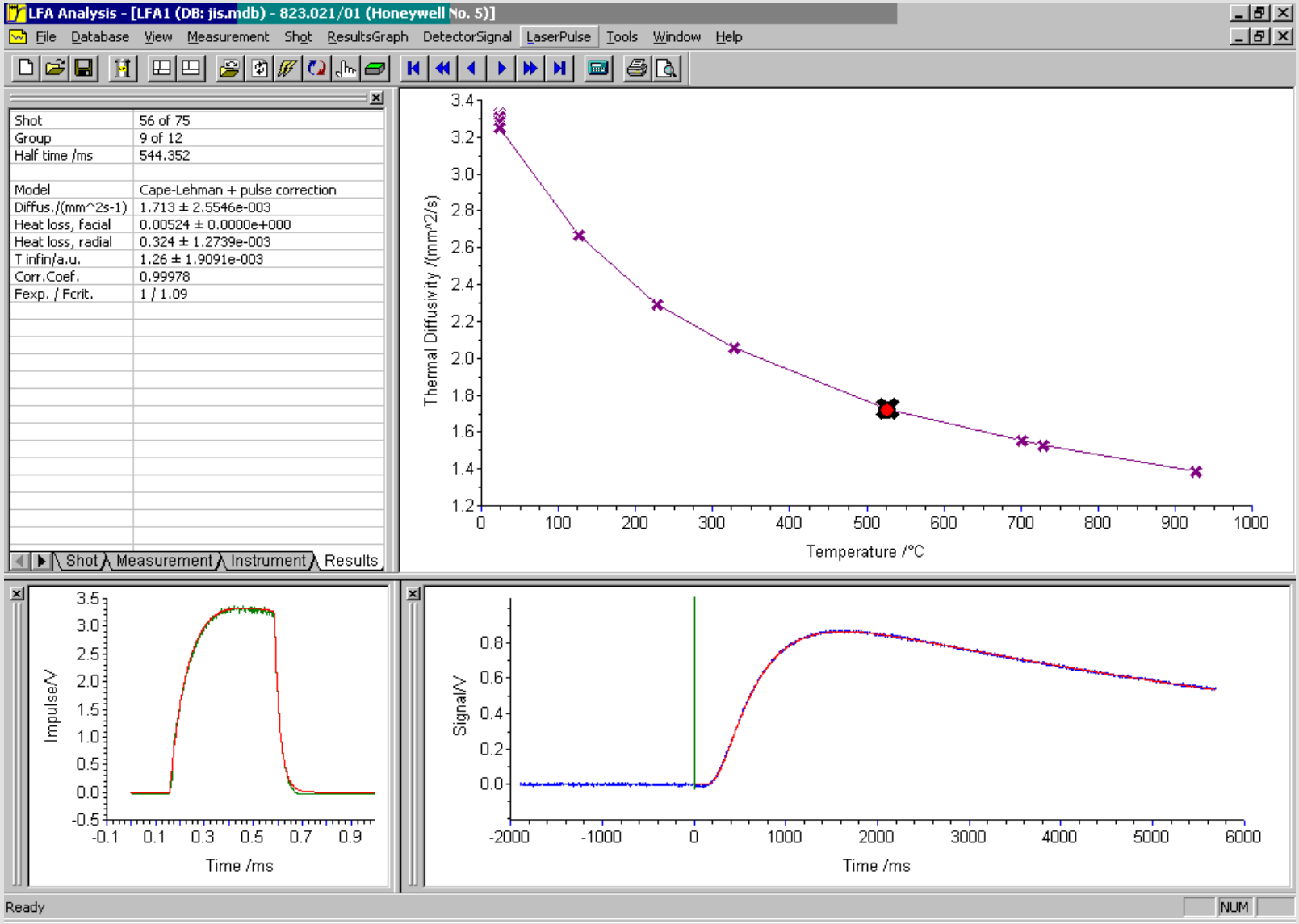


Specific Heat Capability of the LFA Method



$$\lambda(T) = a(T) \cdot c_p(T) \cdot \rho(T) .$$

Laser Flash – Modern Evaluation Routines



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  - Instrument Specifications

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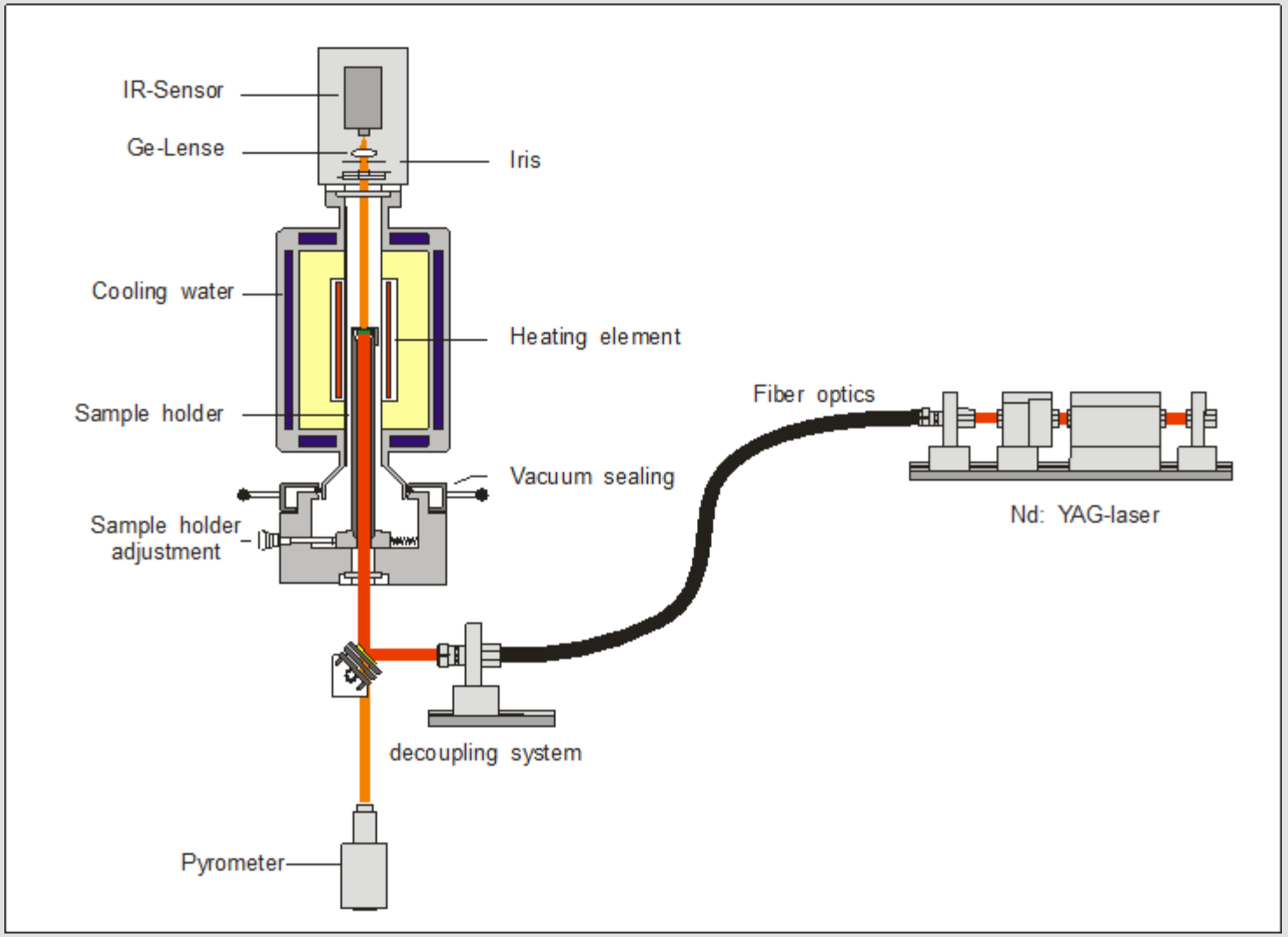
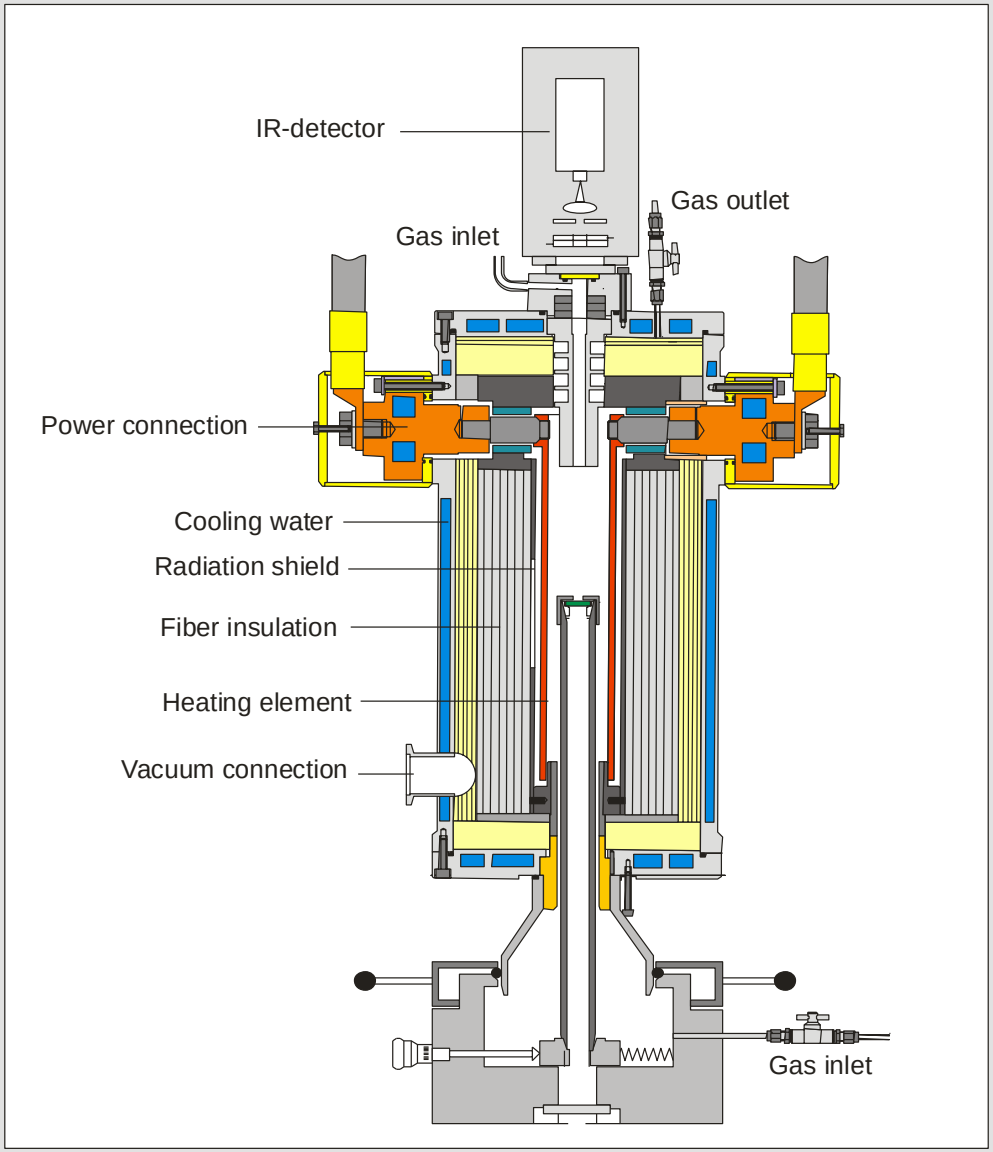
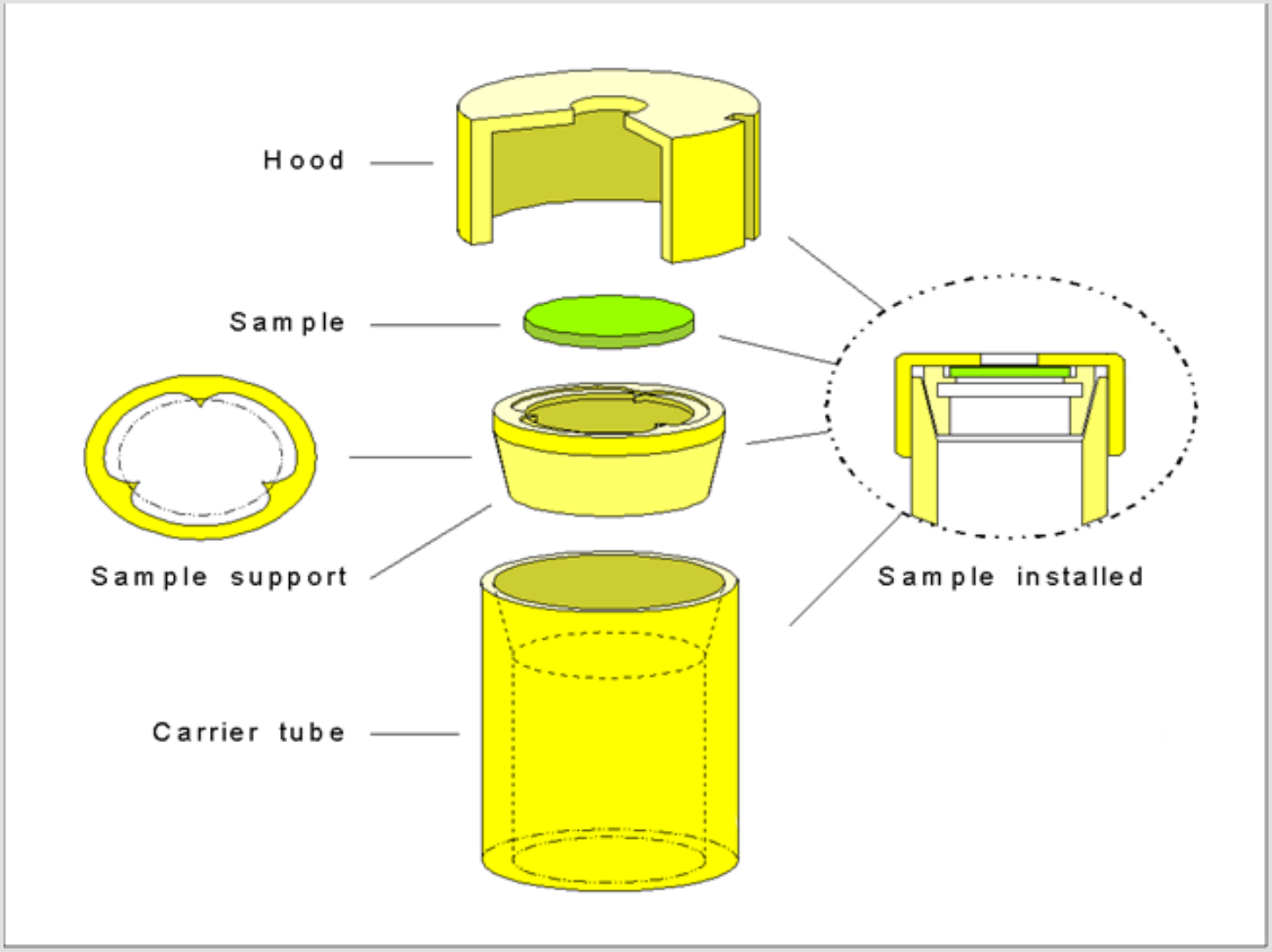
Laser Flash – Concept for Highest Temperatures



Laser Flash – Concept for Highest Temperatures



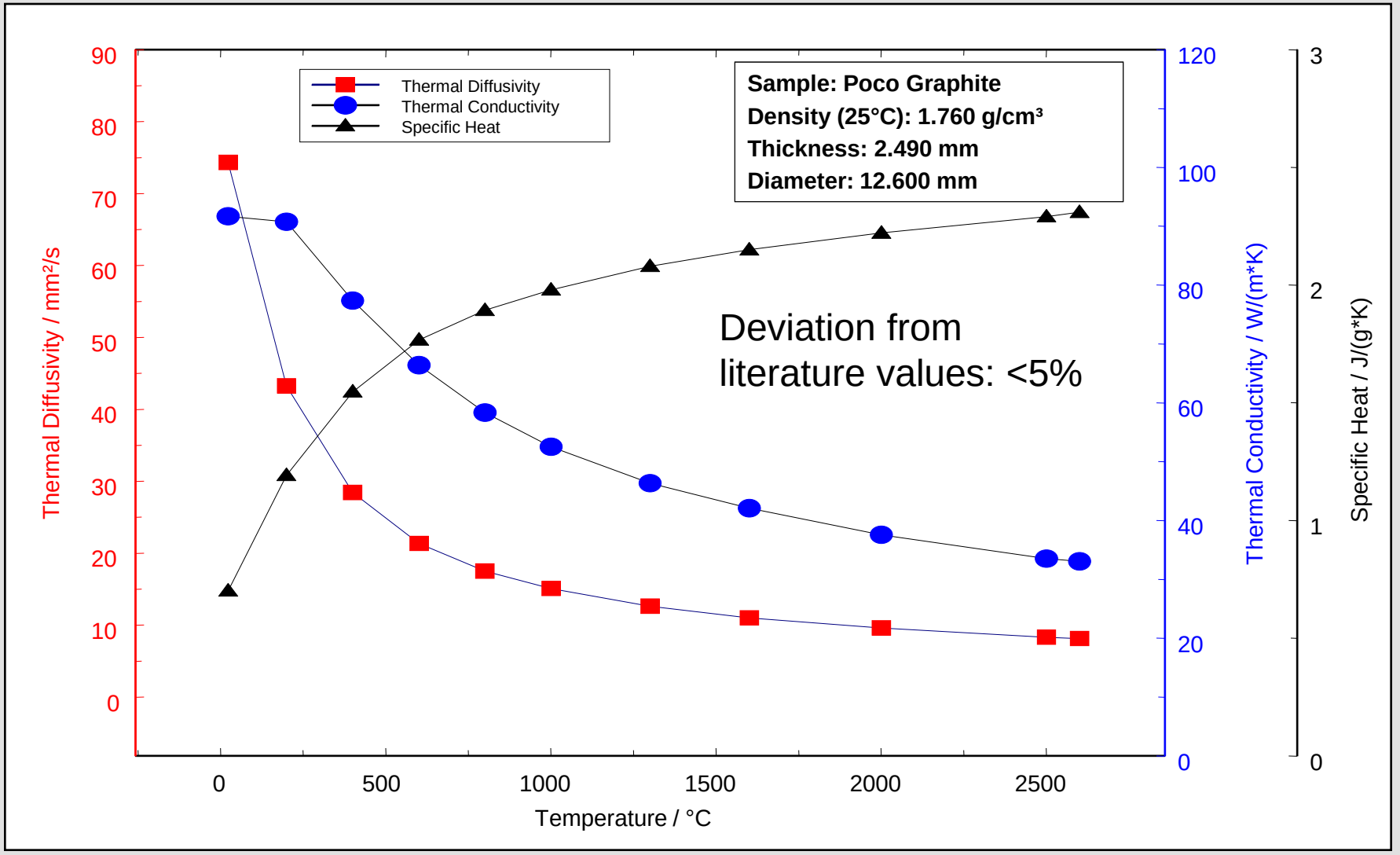
Laser Flash – Sample Holder



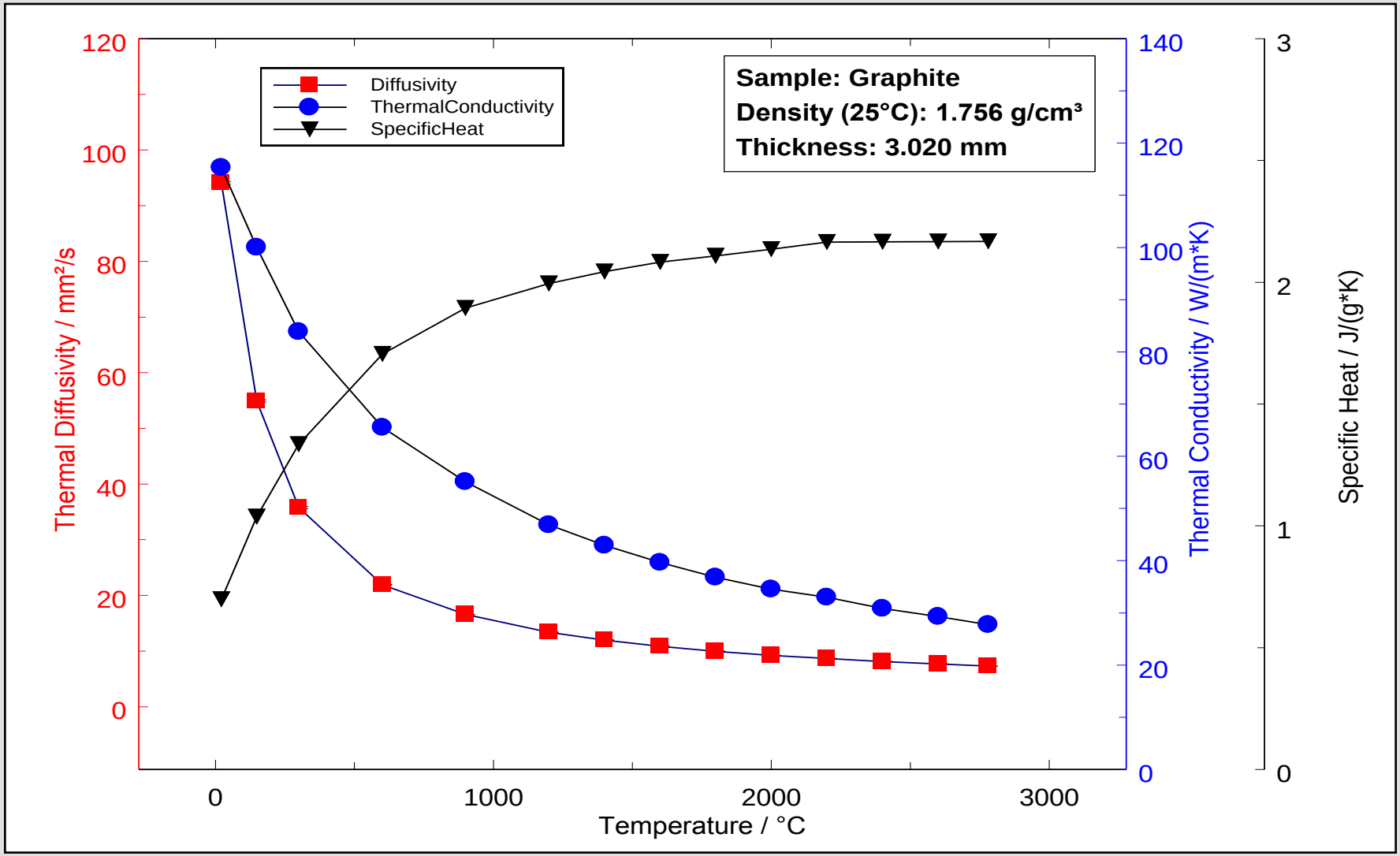
Laser Flash – Instrument Setup: NETZSCH LFA 427/8/G Pyro

Temperature range: RT to 2800 °C

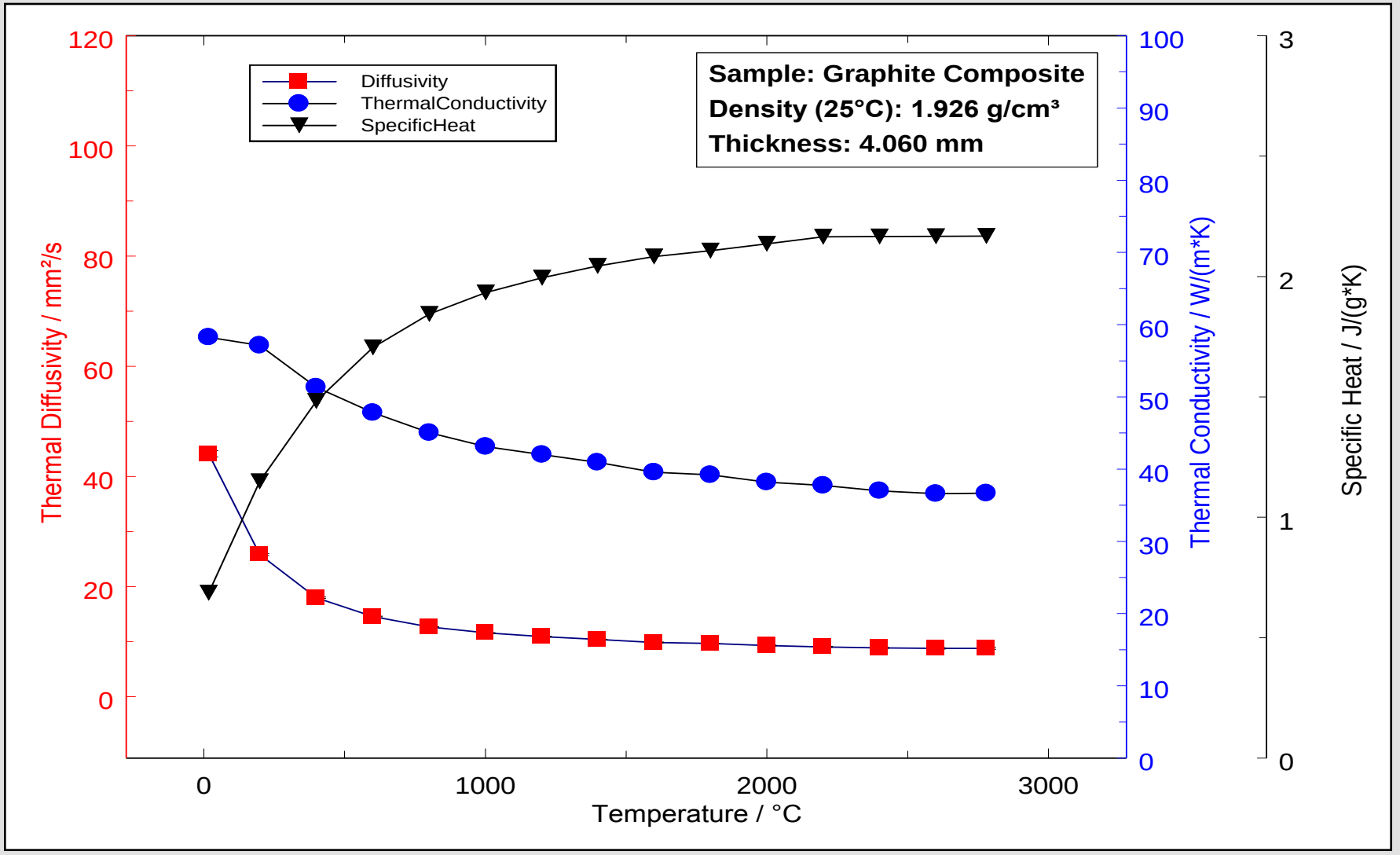
Application: Poco Graphite



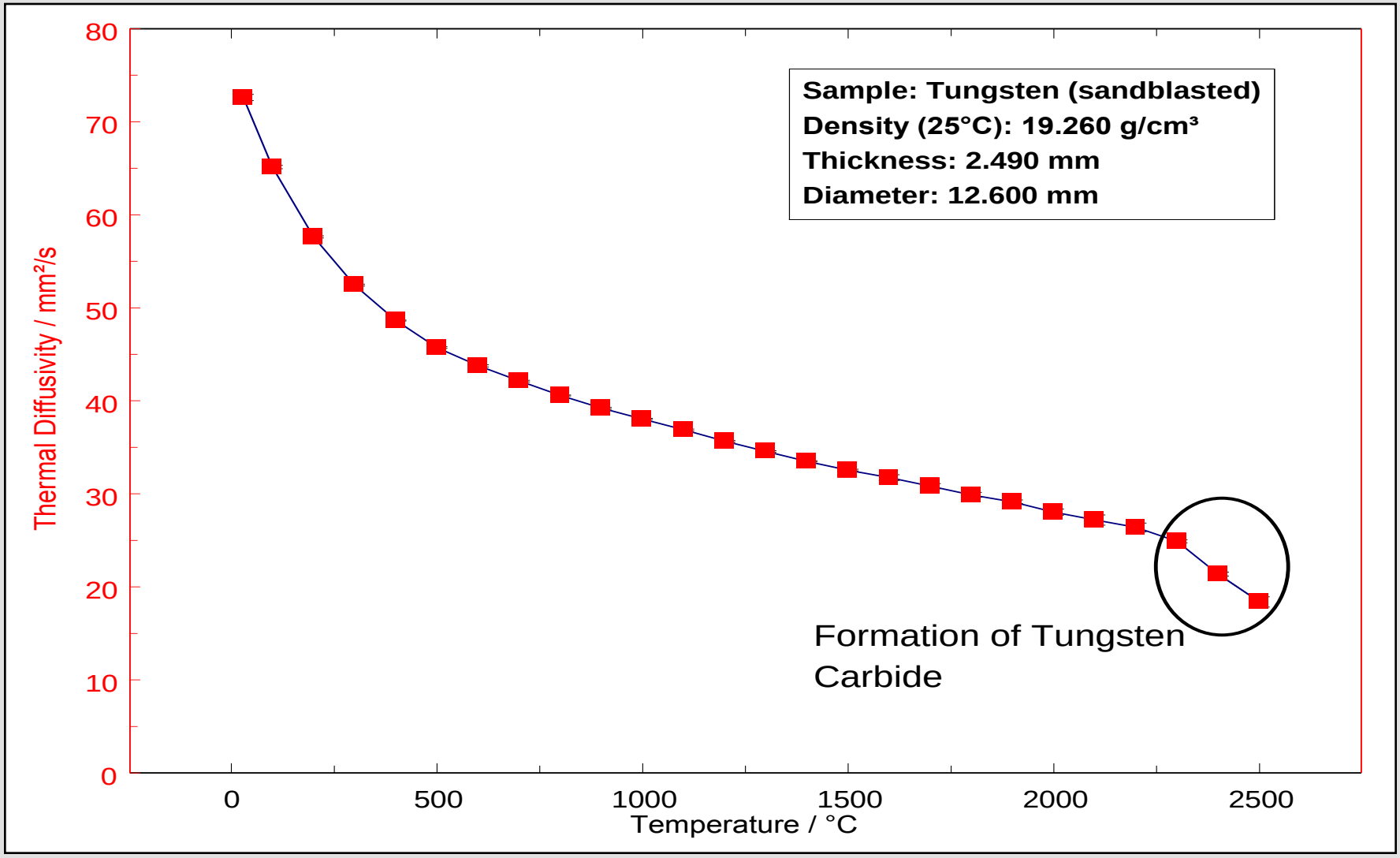
Application: Graphite up to 2800°C



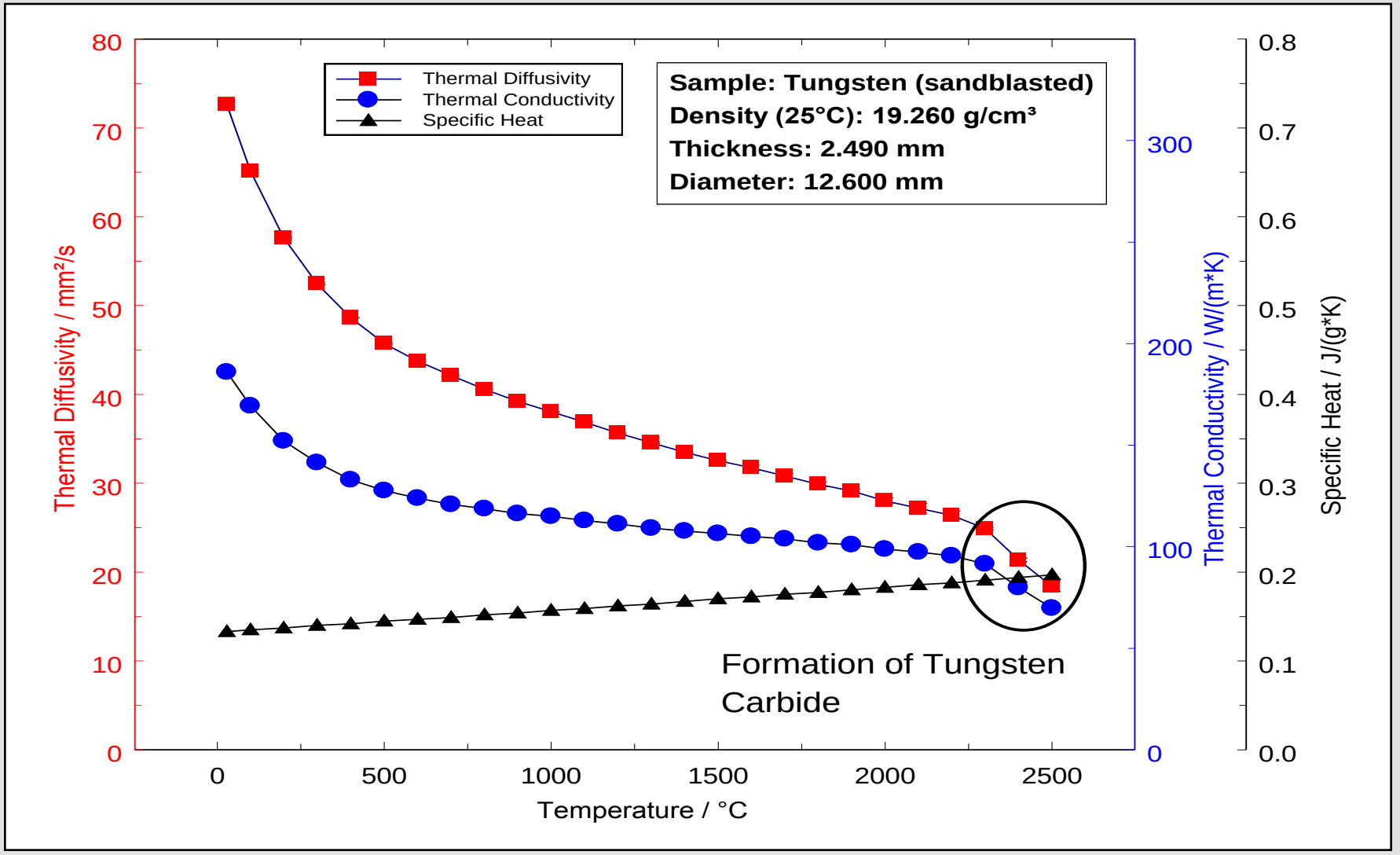
Application: Fiber Reinforced Carbon Composite up to 2800°C



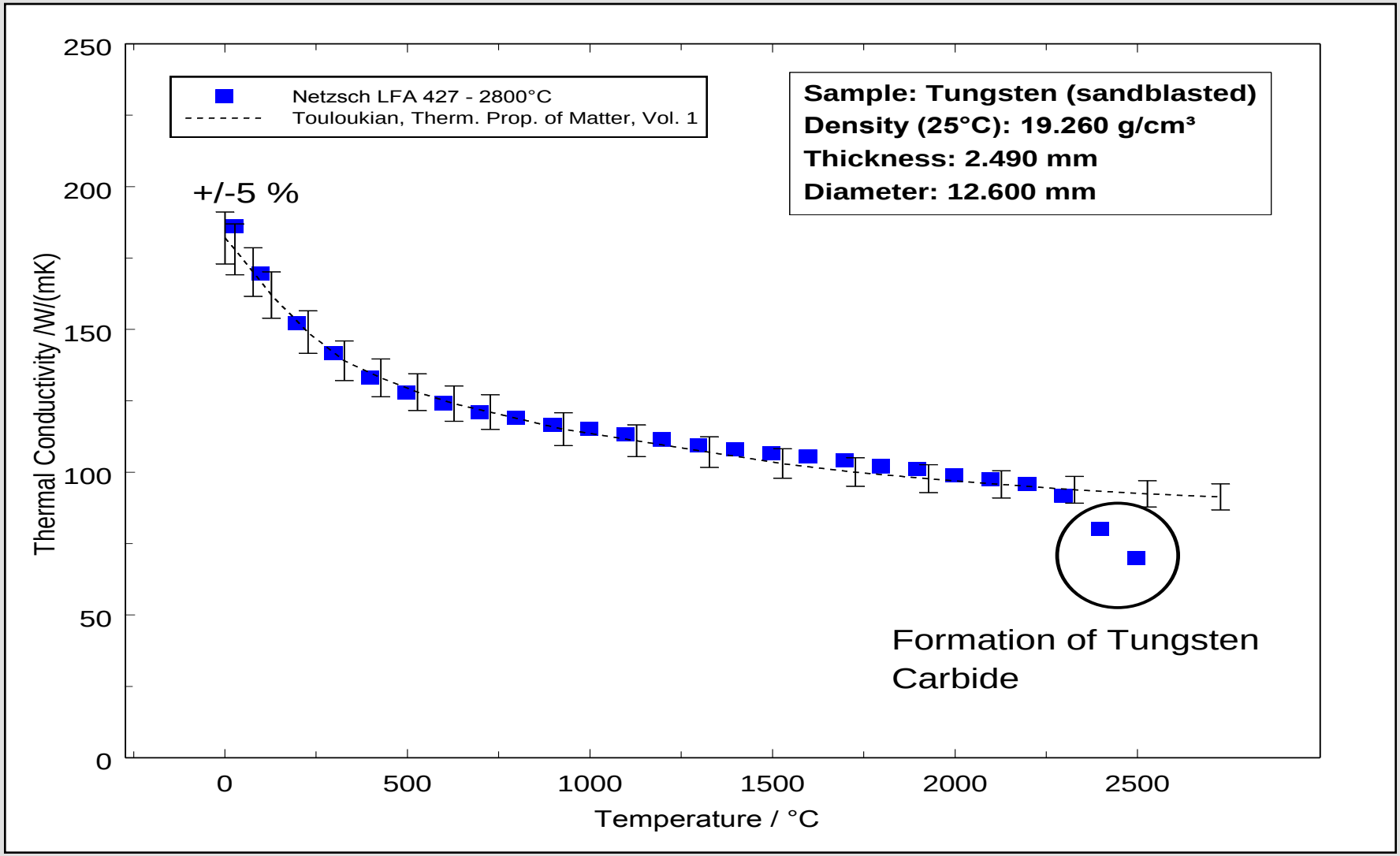
Application: Tungsten up to 2500°C



Application: Tungsten up to 2500°C



Application: Tungsten up to 2500°C



Conclusion

An extension of an existing laser flash system for temperatures up to 2800°C was developed.

Using a special furnace and a calibrated wide-range pyrometer for the sample temperature measurement allow safe tests above 2800°C.

Various application examples have proven the performance of the new system.