Hot Disk®

The leader in transient techniques

Hot Disk TPS 2500 thermal conductivity measurements on washing powder under varying pressure

About the Hot Disk instrument

The Hot Disk Thermal Constants Analyser is a system designed to conveniently measure the thermal transport properties of a sample, i.e. thermal conductivity and thermal diffusivity. From these two parameters the specific heat capacity can be derived. The system is based on a patented Transient Plane Source (TPS) technique, which can be used to study materials with thermal conductivities from 0.005 to 500 W/mK and covering a temperature range from 30 to 1000 K.

The following modes of operation are available with the Hot Disk instrument:

The Hot Disk TPS 2500 system

Introduction

Thermal conductivity measurements on powders of varying composition are readily carried out with the Hot Disk TPS 2500 system.

Commercial washing powder has been tested for thermal conductivity. Since the properties of the sample in powder form will differ from the bulk properties of the individual grains, the tests were carried out with varying pressure. This procedure indicates that the Hot Disk TPS 2500 system could be used for characterising pressed tablets or loose powder in situ. The routine described in this application note is applicable to most powder types.

Measurements

The tests were carried out with a Hot Disk TPS 2500 system and a special sample holder for powder samples, see fig. 1 below. A sensor with radius approximately 6.4 mm was used together with measurement time 40 seconds and power 40 mW. Three tests were carried out with 0 pressure applied and also when 5471 g of weight was applied. All other measurements were only carried out one time.

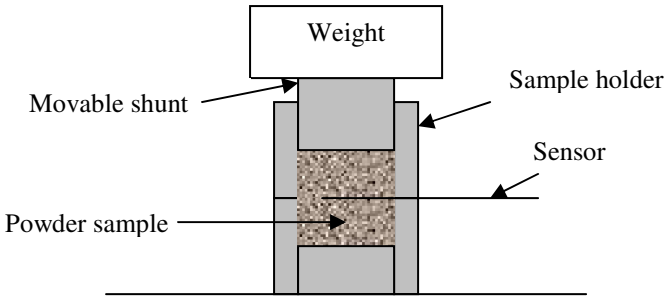

Fig. 1. *Specially designed cylinder shaped sample holder for liquid polymers and powders.*

1) ***Standardmethod***: The sensor is sandwiched between 2 sample pieces. This method also features a single sided option.
2) ***Thin Film method***: A special extremely sensitive sensor is sandwiched between 2 pieces of the film (10-500µm).
3) ***Slab method***: For very conducting materials (> 10W/mK like SiC, Cu etc.).
4) ***Anisotropic method***: This method measures the anisotropic thermal conductivity and diffusivity of a uni-axial sample.
5) ***C_p***: Determines C_p of solid samples.

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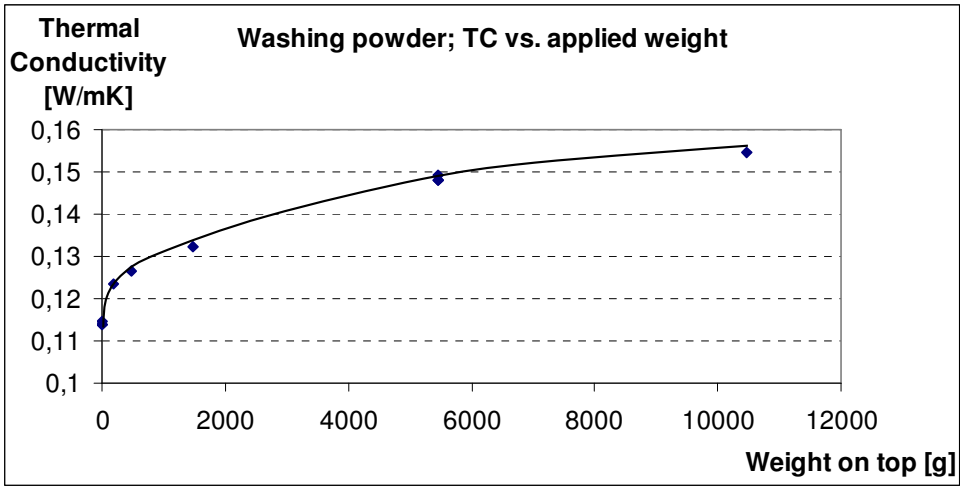
Results and Discussion

The results were (these values are plotted in the graph below):

Weight applied [g]	Thermal Conductivity [W/mK]
0	0,1141 +/- 0.0004
176	0,1235
471	0,1267
1471	0,1324
5471	0,1494 +/- 0.0007
10471	0,1545



Comments

The thermal conductivity increases monotonically with increasing pressure. This can be explained by the fact that as the powder particles get closer and closer to each other the air content in the sample is reduced. The measurements show that it is possible, whithin one experimental set-up, to analyse compressed powders, such as tablets or pellets. For these measurements the largest weight available was a loose 10 kg weight plus additional small weights (471 g). The measurement point which were repeated (0 g and 5471 g applied) repeated themselves whithin 0.5 %.

Measurements on powders are easily carried out with the Hot Disk TPS 2500 system. All these measurements were performed over a time interval of 2 hours. For high temperatures (i.e. in a furnace), the same sample set-up would be used.

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