

Authors' response to the comments of reviewer 2 in the interactive discussion on the manuscript: "Influence of probe geometry on measurement results of non-ideal thermal conductivity sensors" by P. Tiefenbacher et al.

Why is only the middle one of three RTD sensors used for the thermal conductivity measurements with the two prototype sensors?

The reason is that it is supposed that the RTD close to the needle base is significantly influenced by the heat capacity of the mounting stud, while the influence of the finite length of the needle on the RTD at the tip is not really understood yet. So we decided to use only the middle RTD for these measurements. Further investigation and measurements concerning this problem will be conducted.

How much do the temperature values of the three RTDs differ from each other and can further information about the sample be derived from that additional temperature values? Can the temperature difference give an estimate how much the results will differ from the one of an ideal thermal conductivity sensor?

The maximum temperature difference between the three RTD is in the range of 0.5 K to 3 K, depending on the sample material the measurements were conducted in. Measuring the vertical temperature gradient with all three RTD will definitely give additional information about the material and the sensors itself. Therefore, answering those questions is the aim of further investigations.

Is there an explanation why the thermal conductivities measured with the prototypes are most of the time higher than the values measured with the reference sensor?

This is a systematic deviation due to the different geometry of the sensor types. The prototype sensors are thicker and shorter than the reference sensor and so axial heat flow and finite thickness play a more significant role, which is not yet taken into account by the applied evaluation model. A corresponding improvement of the evaluation is planned.

Further the choice of some of the sample materials used for the measurements is not comprehensible to me. The measurements should show that the prototypes described give the same results as a commercial sensor if multiplied by a scaling factor. In this content I cannot see how measurements with materials like firn and limestone were no accurate reference values are known are used, specially limestone were only measurements with one sensor type could be done and therefore not even the values of different sensor types could be compared. And why where, in case of glass beads, the measurements of the two bigger grain size ranges only be done with the commercial sensor, how is this helpful in proving the functionality of the prototypes?

These comments and questions refer to the original version of the paper and have already been changed in the revised version for the interactive discussion.

It is mentioned in chapter 6 that the temperature increase due to heating is not high enough to get phase change in case of frozen samples. I think there should be a short note about this already in chapter 4 when the first measurement results for frozen samples are presented. The question if there is any phase change arises already at that point.

The information about that fact has been inserted in Sect. 4.

Page 8: The list of parameters is not necessary, except of P all parameters are explained already and P is not mentioned in the paper, the heating power is always given by I and R.

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Page 12, line 27: a length of 150mm and a diameter of 1.5mm lead to a length-to diameter ratio of 100. I guess the authors mean the ratio of the length of the heated segment to diameter which is 66.

Right, it is the ratio of the length of the heated segment to diameter. The sentence has been corrected.

Figure 7: top right: the red, green and black lines can hardly be seen. Bottom left: in the picture the green line is labelled nonlinear fit, in the figure caption the green line is labelled linear fit, this needs to be corrected. I suggest this figure to be enlarged.

Figure 7 has been changed according to the suggestions and the caption has been corrected.

Table 2: There are two different k-values for agar ice and water ice, according to your description it should be the same one.

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Authors' changes in the manuscript: "Influence of probe geometry on measurement results of non-ideal thermal conductivity sensors" by P. Tiefenbacher et al.

The title of Sect. 3 was changed to "Experimental setup" and is now including "Measurement probes" and "Sample materials" as subsections. Therefore, Table 3 was shifted from Sect. 4 to Sect. 3.

Table 11 and Table 12 were merged to one table.