**Manuscript category: Original scientific paper**

**Electrofreezing of phase-change material CaCl2·6H2O and its impact on supercooling and nucleation time**

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The authors presented the influence of electric field on the nucleation process of the phase-change material CaCl2·6H2O. They showed that the increase of the voltage reduces supercooling degree, but also affects the induction and the overall phase transformation time.

After careful consideration, the decision is that the manuscript can be accepted for publication after **major revision** which will include corrections based on the comments listed below:

Dear reviewer,

We thank you for your kind comments and questions. We have revised the manuscript based on your suggestions, comments, and questions, as detailed below.

1. Page 9, line 173: add that the case when external field is applied at temperature 45C is also investigated.

Answer:

Thank you very much for your advice. We have added, in the Experimental section, details pertaining to the investigation of the external field at 45 °C for V = 1.5 kV (lines 174-175).

1. Add in the text that case (b) without electric field from Figure 2 is used for comparison on Figure 3 with different values of voltage of electric field.

Answer:

Thank you for your comment. We have added in the text that case (c) without an electric field from Figure 2 was used for comparison in Figure 3 with different values of voltage of the electric field (line 203).

1. Caption on Figure 4 is nor correct: temperature-time curves are presented on (a) and (c) and temperature-derivative on (b) and (d).

Answer:

Thank you very much for your observations. We have made the required corrections to the caption of Fig. 4 (line 226).

1. If induction time is presented on Figure 5(a) then the abbreviation on the graph is not correct. Also for the case without electric field seems that the values are not correct, and if you compare it to Figure 2 (and Figure 4(a)) it seems that supercooling time is presented instead of induction. Are there five different values on the graph for the cases of applied voltage since the measurements with field were repeated five times?

Answer:

Thank you for your observations. We have made a correction to the vertical axis of Fig. 5, namely, induction time (tind). Furthermore, we amended the border of induction time in Fig. 4(a) for V = 0 and added the information for the insets. With the application of the field, the spread in induction times was reduced significantly, so that many data points are overlapped.

1. The authors mention that the time for the overall phase transformation of the sample to the solid phase (crystallization time) is significantly increased. Is it a desired consequence and does it affect the potential usage of the investigated material?

Answer:

Thank you for your question. Our experimental results for CaCl2·6H2O demonstrated that with an increasing applied field, the crystallization time (*tc*) tended to become longer, similar to the reports for water by Wei et al. [37] and Orlowska et al. [38] for water sample. According to Orlowska [38], this phenomenon is related to the large amount of refrigeration energy stored; due to the decrease in nucleation time, a large amount of heat that must be removed during the phase transition results in a longer solidification time. We have written this argument in Results and Discussion part (line 306-310).

In the case of CaCl2·6H2O, the difference of *tc* for the zero field and maximum applied field (5 kV) was approximately 6 min (Fig. 5(b)). Consequently, this might not influence its potential application in passive air-conditioning systems.

1. Add to the caption of Figure 6 the value of the applied voltage of electric field.

Answer:

Thank you for your correction. We have added the value of the applied voltage, namely, 1.5 kV, to the caption.

1. Page 16, line 276 and 280: Did the authors wanted to say nucleation and not freezing temperature?; “...controlling the electric field resulted in a significant increase in freezing temperature, up to a certain value.” and “The electric current flow triggered heterogeneous electrofreezing and indicated a higher freezing temperature.”

Answer:

Thank you for your correction. We have corrected the required sentences by stating that the effect of the electric field was a significant increase in the nucleation temperature.

1. Remove the first sentence from the Conclusion part.

Answer:

Thank you for your suggestion. We have removed the first sentence from the Conclusion.