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OPPONENT REVIEW

of Doctoral Thesis

Cooling of Aluminium Coils by Forced Ventilation with Outdoor Air

Author : **Dieter Sedlacek, Dipl.-Ing.**
Supervisor : Prof. Ing. Berenika Hausnerová, Ph.D.
Degree program : P3909 Process Engineering
Degree course : 3909V013 Tools and Processes
Faculty of Technology, Tomas Bata University in Zlín

I work out the review on the basis of the appointment of the Dean of the Faculty of Technology, Tomas Bata University in Zlín as the opponent of the doctoral thesis on 19 October 2020.

This thesis is focused on the cooling of aluminum coils by air forced convection. The main goal is to replace the active cooling with a more economical and environmentally friendly method and eliminate the otherwise necessary logistic step of relocating the coils after cooling. The work contains 95 pages.

In the first part of his work, the author conducted an extensive literature study on the properties and production of aluminum foils as well as methods of heat transfer by convection and radiation from the surface of coils.

In the following chapters, he focused on a detailed analysis of the problem and the design of solutions using process engineering tools, i.e., mathematical modeling and simulations using Ansys Fluent or Autodesk CFD software.

The main objectives of the work can be summarized as follows:

- Characterize and analyze the current course of cooling
- Design of a new way of cooling coils
- Design of a mathematical model for simulation of coil cooling
- Design of efficient airflow around coils and finally experimentally verified in real conditions

Goal fulfillment

I note that the author chose appropriate methods of solution and processing. The set goals of the work are fully met in their entirety.

Actual topic and importance of work for practice

I consider the topic of the dissertation to be highly topical and beneficial. The author designed a new system for cooling aluminum coils, which is efficient, at the same timeless costly, more technologically advantageous and especially environmentally friendly. With regard to the worldwide production of aluminum foils, a really topical problem important for practice is solved in this work.

Formal level

Dissertation work created by Ing. Sedlacek is quite precisely processed, is clearly structured; the continuity of the individual chapters has a logical structure. Graphic processing of pictures and graphs is mostly good.

Reminders

- The work should be detailed the main and partial objectives of the work; goals are given only in the introductory part, should be devoted to a separate chapter, which would include partial tasks.
- The units must also be listed in the list of symbols.
- Better use of the term Natural convection (not free convection)

Despite some shortcomings of a rather formal character, the dissertation has a high professional level and importance for practice.

Questions

1. Have you considered using heated air by coils for recuperation?
2. What boundary condition did you consider the heat sharing between the coil surface and the ambient air?
3. When solving the problem at such high coil temperatures, the part of heat transfer by radiation is not negligible. Did you also calculate the radiation into account when designing the model?
4. It is not understood which coil size you used as characteristic length L_c in the Nusselt criterion for natural and forced convection.

Final evaluation

In his work, Ing. Sedlacek decided to handle a challenging task, which he fulfilled very well in its entirety. He proved that he masters scientific methods of work in solving a specific task, proved his extensive theoretical knowledge in the field of Process Engineering, and the practical part, and understanding of some passages from Automatic Control.

The dissertation is prepared at a high professional level. He brings new knowledge, shows his excellent professional skills and ability to independent creative scientific work. I highly appreciate the implementation of demanding practical experiments in a Chinese factory, which confirmed the simulated results in practice.

I recommend the author to publish more the achieved and remarkable results of the current research.

The content of the dissertation thesis certainly meets the demanding conditions for the doctoral procedure in accordance § 47 Act on Higher Education Institutions No. 111/98 Sb. For this reason:

I recommend for defense.

D o p o r u č u j i k o b h a j o b ě .

Zlín, 10. 11. 2020


Dagmar Janáčková
Opponent