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Review of Dieter Sedlacek's

doctoral thesis

entitled

Cooling of Aluminium Coils by Forced Ventilation with Outdoor Air

by

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Dieter Sedlacek's doctoral thesis presents the results of his scientific work to develop a new cooling concept for aluminium coils that is technically and economically more efficient and also environmentally friendlier. Compared to the production process of aluminium the share of energy consumption of the cooling process is small as it is mainly process determined. With respect to the huge mass of yearly produced aluminium the optimization of coil cooling can lead to remarkable energy and costs savings as well as reductions of environmental impacts.

Having this in mind Dieter Sedlacek treated this applied topic with an engineering approach that combines practitioner's acting with scientific support (93 references) and structured it with respect to his aims and the corresponding problems. He defined the following relevant topics for his PhD thesis:

1. Evaluation of existing concepts and models of cooling for mainly steel and its transferability to aluminium taking into account process differences.
2. Thorough analysis of the cooling conditions of individual coils in ware houses, development of alternative optimized cooling concepts and their comparing evaluation.
3. Transfer and implementation of the "best" cooling concept in a ware house which allowed for the verification of the theoretical results and the quantification of energy and costs savings.

The outcome of Dieter Sedlacek's engineering work is a significant improvement of the cooling process of aluminium coils. Using the new concept of forced ventilation with outdoor air lead to the following remarkable results:

- the shorting of cooling times from 7 days to less than 2 days
- a reduction of the energy consumption by a factor 16
- the development of both an analytical and a numerical cooling model of aluminium coils taking into account coil geometry and arrangement of air ventilation system

Although the topic of Dieter Sedlacek's PhD work is highly application related he was also able to publish the results in up to now two papers entitled

Paper I: Cooling Aluminium Coils by Outdoor Air

Paper II: Cooling Aluminium Coils: Numerical Simulation of Airflow for Ventilation System Design

Another impressive aspect of his PhD work is the fast transfer to application by implementation of a corresponding cooling system in a company ware house in China.

Dieter Sedlacek submitted a clear and well-structured scientific work which demonstrate the big economic and ecologic potential of minor improvements in apparently well-established processes. Congratulation to this excellent engineering work and highly application related doctoral thesis which I recommend to be accepted!



Prof. Bernhard Möglinger

Additional comment

As every doctoral thesis leaves some open and unclear points. Therefore, the following questions should be answered in the defense:

1. Do you think that the developed cooling models can be used for coils of other metals or alloys, and what are the key changes in the models for a successful transfer?
2. You have quantified the savings in energy and CO₂ emissions for the German grid. Did you also take into account the CO₂ emissions linked to the building which can be reduced to one third in size?
3. You calculated the heat transfers due to convection and radiation as well as the total heat transfer for free convection (page 54) and forced convection (page 56). Can you explain why the total heat transfer is smaller than the sum of the heat transfers due to convection and radiation?