

Energy saving potentialities connected with the use of high efficient heat exchangers in different technological areas

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Abstract

Energy saving and the issues connected with the energy demand reduction is matter of interest for a large number of researchers all over the world. The energy saving of a complex system could be pursued into two different ways: the energy demand reduction and the energy efficiency enhancement. Both of targets cannot achieved without take care of the users and the energy production system temperatures. A 2nd thermodynamic law approach leads toward the exergy analysis, that linked the different energy rates to the temperature of the heat supplying o receiving source. In the most of the energy demanding systems the energy saving potentialities are therefore strictly connected with the efficiency of the heat transfer devices that allows the heat transfer among the system and the energy sources. The energy saving potentialities or even the capability to recover energy by waste heat with very low differences of temperature are actually limited by the heat transfer efficiencies of the heat exchangers.

Compact two-phase heat exchangers are innovative heat transfer devices capable to transfer relevant heat rates with very low differences of temperature. Innovative heat transfer devices, named as “Heat Pipe” or “Two-Phase thermosyphon”, are closed pipes filled with a fluid at the thermodynamic equilibrium, capable to transfer high heat fluxes in a fully passive way. Heat pipes externally appear as a metallic bar, even if their equivalent thermal conductance is up to 1000 times higher than a high conductivity metallic bar (copper or aluminium). The seminars aim at describing the heat pipe technologies and showing their potentialities in terms of energy saving for different technological applications.

State of the art of heat pipe technologies and applications: 4 hours

The seminar is opened at PhD students coming from different research skills. The subject will be dealt with interdisciplinary methodology.

After a brief introduction on the two-phase heat transfer mechanisms, the heat pipe performances and the operating principle will be described together to the heat transfer limits and the technical peculiarities of these heat exchangers. In the second part a wide literature review of heat pipe applications will be shown. In particular will be shown their potentialities in energy saving and thermal control in several and different areas: energy building, thermal control of electrical and electronic devices (Battery thermal management, IGTE and electronic equipment cooling), thermal control of LED lamps, ground applications, geothermal applications, industrial applications and others.

The Heat Pipe physics: 4 hours

The seminar is aimed at all the student interested in the understanding of the heat pipe physical mechanisms. A review of the heat pipe modelling and simulation tools will be described. The pressure and the thermal balance will be described and a summary of the heat transfer in porous media will be shown.

The main correlations to predict the heat transfer coefficients inside the heat pipe and the heat transport limitation will be shown in details.