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Heat and moisture recovery with membranes: From fundamentals to engineering applications

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Energy consumption by air conditioning accounts for 1/3 of the total energy use by the whole society. Cooling and dehumidifying fresh ventilation air constitutes 20-40% of the total energy load for air conditioning in hot and humid regions. Heat and moisture recovery from ventilation air has become a hot topic for building energy conservation in these years. Of the various technologies for heat and moisture recovery, membrane-based total heat exchanger is a promising alternative. Over the past 10 years, much work has been conducted in South China University of Technology for the research on membrane-based heat and moisture recovery, from fundamentals to engineering applications. In this review, the progress of these researches is introduced. More specifically, some novel concepts are proposed for heat and moisture transfer analysis. Several novel membranes are designed to accomplish the goal. Some novel exchanger structures are constructed and the heat and mass transport phenomena is investigated. Novel prototypes are built for engineering applications. The results are that a sensible effectiveness of 0.8 and a latent effectiveness of 0.7 are obtained for a total heat exchanger with novel materials and new constructions. When the total heat exchanger is combined with a fresh air refrigeration dehumidification unit, the system COP is improved to 5.8. The membrane systems have been extended to other areas like air humidification, liquid desiccant air dehumidification, and fabrication of selective adsorbents. This review gives a summary of these works and also points out the future research directions.

Biography

Li-Zhi Zhang is a Professor at South China University of Technology (Guangzhou, China). He received his Doctor's degree in Thermal Engineering from Dalian University of Technology in China in 1998. He then conducted his Postdoctoral researches in Tsinghua University (Beijing) from 1998-2000, and in the Hong Kong Polytechnic University from 2000-2003. In 2003, he joined South China University of Technology as one of the youngest professor at that time in SCUT. He is now the Director of the research center for Built Environment Technologies. He has worked with energy recovery, heat and mass transfer, and advanced humidity control technologies since 1992. His primary interest is on heat and moisture recovery from ventilation air with membrane technologies.

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