Advanced HVAC&R solution enabled by novel design, materials, and manufacturing processes

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KASHIF NAWAZ

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BIOGRAPHY

Dr. Kashif Nawaz earned his BSc in Mechanical Engineering from Ghulam Ishaq Khan Institute of Technology in Pakistan in 2007 and his MSc and Ph.D. in Mechanical Engineering from University of Illinois at Urbana Champaign (UIUC) in 2010 and 2013 respectively. After graduation, he joined the Heat Transfer Center of Excellence at Johnson Controls (JCI), where he worked as Senior Heat Transfer Engineer until 2016. During the same period, he also worked as adjunct faculty in the Department of Mechanical and Aerospace Engineering at the University of Oklahoma. In 2016 he joined the Oak Ridge National Laboratory, where he is currently working as a senior scientist in the Building Equipment Research Group with a joint appointment to the Tennessee Technology University at Cookeville, TN. Over the past fifteen years of active research and development work, Dr. Nawaz has established himself as a leader in fundamental and applied energy conversation science and technology. He is widely recognized for his work in different aspects of buildings heating, cooling, dehumidification systems including novel heat exchanger, enhanced phase change processes through the deployment of additive manufacturing, porous media and surface morphology, heat pump air and water heating, efficient separate sensible and latent cooling systems and emerging refrigerants. He has pioneered the development of a new generation of high-temperature heat exchangers manufactured with ceramics and composites using additive manufacturing. More recently, his research has led to the development of unique concepts for direct air capture of carbon dioxide using existing buildings' infrastructure. Dr. Nawaz has authored or coauthored more than 110 peer-reviewed publications including journal articles, conference papers, and reports. He has more than 20 invention disclosure and two provisional patents on heat exchanger design and energy conversion processes. Dr. Nawaz is the recipient of the 2018 Distinguish Service Award by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), JCI Excellence in Innovation during 2016, and the UIUC Alumni Teaching Fellow Award during 2011 and 2012.

ABSTRACT

Heating, ventilation, air conditioning, and refrigeration have been considered matured technologies since they have been commercialized and to a large extent have been able to meet the expectations. With the growing interests in energy efficiency, environmental impact, multi-functional building equipment, and the importance of indoor air quality, it is critical to overview the development and to identify the opportunities for improvement. The latest developments in design optimization, novel materials, and advanced manufacturing have the potential to enable unprecedented technological developments that cannot be achieved through conventional approaches. The discussion will focus on specific applications where the deployment of such emerging technologies can provide substantial performance improvement, reduction in capital and operational cost and potentially can enable the deployment of emerging refrigerants. Advanced heat and mass exchanger, energy storage systems, and combined dehumidification and CO2 capture are a few examples that can leverage from advanced design, material, and manufacturing technologies to provide novel solutions.

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