Cooling by Solar, Water, and Air

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https://doi.org/10.15017/1906112

出版情報：Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 3, pp.19-20, 2017-10-19. Interdisciplinary Graduate School of Engineering Sciences, Kyushu University
バージョン：
権利関係：

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Short Biography

Takahiko Miyazaki is a Professor in Department of Advanced Environmental Science and Engineering, Faculty of Engineering Sciences, Kyushu University. He holds a BSc in Mechanical Engineering from Chuo University, Japan and MSc in Renewable Energy and Architecture from the University of Nottingham, UK, and PhD in Engineering from Tokyo Agriculture and Technology (TUAT), Japan. He worked as an Assistant Professor at Faculty of Engineering, TUAT before he joined Kyushu university as an associate professor in 2011. His specific research interests are in energy savings by utilization of low grade thermal energy. He involved in several research projects, and currently working on "Research and development of waste heat driven cooling heat pump for automobiles" in Thermal Management Materials and Technology Research Association (TherMAT). He has published about 150 articles in peer-reviewed journals and international conference proceedings. He supervised a Japanese book on "Low Temperature Waste Heat Utilization Technologies by Adsorption Refrigerators/Heat pumps". He recently served as the secretary general of the International Sorption Heat Pump Conference 2017. He is serving as a guest editor of the special issue "Sciences in Heat Pump and Refrigeration" in Applied Sciences.

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Abstract

In modern city, air conditioning is installed most of the buildings, and it is essential for convenient and comfortable life for human beings. In addition, it is also indispensable to some industrial or agricultural processes. It is a large energy consumer, however, and it sometimes causes a shortage of electricity during a peak demand time of space cooling. Nevertheless, the intensity of space cooling is not so high. For example, the peak cooling demand in buildings is approximately 100 W to 150 W per square meters of floor area. On the other hand, cooling heat flux of nuclear reactor is in the order of hundreds kW/m^2. Heat flux from CPUs is also equivalent to that from nuclear reactor because it generates heat in a very compact body. In terms of temperature, the space cooling does not require large temperature difference from ambient temperature level. The room temperature is kept about 5 to 10 degree Celsius lower than the outside air temperature under Japanese climate condition, for example. For cooling of high heat flux or for cryogenic cooling, we have to use advanced, sophisticated technology. But so does

space cooling? Currently we consume a large amount of electricity, which is expensive and high exergy, for space cooling. In my presentation at IEICS2017, I will show some examples of alternative cooling technology that minimize the use of electricity. The key factors of alternative cooling technology for space cooling are “solar energy” as a driving force, “Water” as a refrigerant, and “Air” as a carrier of cooling effect.