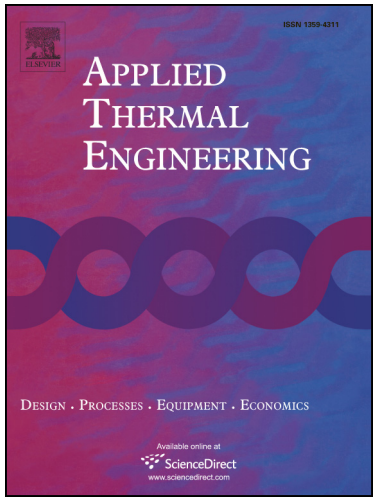

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Effects of material properties on heat and mass transfer in honeycomb-type adsorbent wheels for total heat recovery

Huang-Xi Fu, Qi-Rong Yang, Li-Zhi Zhang[1]

Key Laboratory of Enhanced Heat Transfer and Energy Conservation of Education Ministry, School of Chemistry and Chemical Engineering, South China University of Technology, Guangzhou 510640, China

Abstract: Desiccant wheels have been widely used for humidity treatment: air dehumidification and total heat recovery. Since the operating conditions are different, heat and mass transfer behaviors in the wheels are quite different. This study aims at investigating the performance of honeycomb type desiccant wheels for total heat recovery with various solid desiccant wall materials. A one-dimensional, transient heat and mass transfer model is used to predict the cyclic behaviors of the desiccant wheels. Effects of the working conditions, the rotary speed, the inlet velocities of process air (fresh air) and exhaust air on the performance of the wheel are investigated and compared with various desiccant wall materials. Totally ten most commonly used desiccant materials are considered, with different adsorption and thermophysical properties. It is found that of the 10 materials, the zeolites 5A and 13X perform better than other desiccants for total heat recovery under the high rotary speed (higher than 15 rpm) under typical working conditions. The results are different from desiccant wheels for air dehumidification.

Keywords: Desiccant wheels; Solid desiccant; Total heat recovery; Materials; Modeling

Nomenclature

C	constant in sorption curve
c_p	specific heat (kJ kg^{-1} K^{-1})

[1] Author for correspondence. Tel/fax: +86-20-87114268. Email: Lzzhang@scut.edu.cn