中国化学工程学报 2004 12 (6): 792-800 ISSN: 1004-616x CN: 44-1063/R

THE 13th IDS

湿度标准及湿度计量之进展

IanC.Kemp[a], ,Carl-GustavBerg[b]

[a] Hyprotech UK, Aspen Technology, Gemini Building, Fermi Avenue, Harwell Business Centre, Didcot, Oxfordshire OX110QR, U.K [b] Process Design Laboratory, Faculty of Chemical Engineering, bo Akademi University, Biskopsgatan 8, FIN-20500 Abo, FINLAND

收稿日期 修回日期 网络版发布日期 接受日期

摘要 Determination of the wet-bulb temperature at the surface of a material is the basis of one class of humidity measuring instruments, and is important in industrial applications such as dryer modelling and simulation. The psychrometer equation is a frequently used method of estimating wet-bulb temperature, and contains a psychrometer "constant". Analysis shows that this is in fact a variable coefficient affected by temperature, pressure,radiation and conduction effects, and the identity of the gas and vapour. Radiation and conduction affect the difference between adiabatic saturation temperature and indicated wet-bulb temperature. Inconsistencies in currently recommended values for the psychrometer coefficient, including published international standards, are identified and explained. Particular problems arise when the enhancement factor is applied to vapour pressure to account for non-ideality of gases. Special considerations are also needed for wet-bulb temperatures approaching the boiling point, where the psychrometer coefficient tends to zero. Self-consistent recommendations recently published in the new British Standard BS1339 are given, which cover both the air-water system and a general vapour-gas system.

关键词 湿度标准 湿度计量 干燥 干湿球湿度计 蒸汽系统

分类号

DOI:

Developments in Humidity Standards and the Psychrometer Equation

IanC.Kemp[a], , Carl-GustavBerg[b]

[a] Hyprotech UK, Aspen Technology, Gemini Building, Fermi Avenue, Harwell Business Centre, Didcot, Oxfordshire OX110QR, U.K

[b] Process Design Laboratory, Faculty of Chemical Engineering, bo Akademi University, Biskopsgatan 8, FIN-20500 Abo, FINLAND

Received Revised Online Accepted

Abstract Determination of the wet-bulb temperature at the surface of a material is the basis of one class of humidity measuring instruments, and is important in industrial applications such as dryer modelling and simulation. The psychrometer equation is a frequently used method of estimating wet-bulb temperature, and contains a psychrometer "constant". Analysis shows that this is in fact a variable coefficient affected by temperature, pressure,radiation and conduction effects, and the identity of the gas and vapour. Radiation and conduction affect the difference between adiabatic saturation temperature and indicated wet-bulb temperature. Inconsistencies in currently recommended values for the psychrometer coefficient, including published international standards, are identified and explained. Particular problems arise when the enhancement factor is applied to vapour pressure to account for non-ideality of gases. Special considerations are also needed for wet-bulb temperatures approaching the boiling point, where the psychrometer coefficient tends to zero. Self-consistent recommendations recently published in the new British Standard BS1339 are given, which cover both the air-water system and a general vapour-gas system.

Key words psychrometry; humidity; standards; convection; diffusion; enhancement factor

通讯作者:
IanC.Kemp ian.kemp@aspentech.com
作者个人主页: IanC.Kemp[a]; Carl-GustavBerg[b]