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A method based on near-infrared spectroscopy for the in-situ determination of the ammonia concentration in ammonia/water mixtures in an absorber test bench

M. Isabel Barba^a, Miguel Berdasco^a, Daniel Salavera^a, M. Soledad Larrechi^{b,*}, Alberto Coronas^a

^aGroup of Research in Applied Thermal Engineering-CREVER. Mechanical Engineering Dept.

^bAnalytical and Organic Chemistry Dept. Universitat Rovira i Virgili, Tarragona, Spain.

*Corresponding author. Tel. +34 977 559 559, mariasoledad.larrechi@urv.cat

Abstract

This paper discusses the development and implementation of a method based on NIR spectroscopy for the in-situ determination of the ammonia mass fraction of ammonia/water mixtures in an absorber test bench. The calibration model was established using a static measuring system. A cell was designed and constructed to prepare and measure samples at the ammonia mass fractions (0.332-0.482), pressures (3.4-4.6), bar and temperatures (25.0-35.5) °C typical in absorption refrigeration systems. A quadratic model for absorbance at 1041 nm was established and validated. The root-mean-square deviation (RMSD) of the results was 2.1%. To implement NIR spectroscopy in the absorber test bench, a new flow cell was designed. The calibration model was transferred and used in the conditions of the absorber test bench. In these experimental conditions, the model was statistically validated using density measurements as a reference method for measuring the ammonia mass fraction. The root-mean-square deviation between the ammonia mass fractions obtained using the two methods was 1.1%.

Keywords

Near-Infrared spectroscopy, ammonia/water mixture, ammonia concentration, absorber, in-situ measurement

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