This work aims at filling the gap in vacuum-TPD modeling methodology for microporous samples. The specific objective was to assess and distinguish external and internal mass transfer effects from the intrinsic sorption dynamics during temperature-programmed desorption, as illustrated by ammonia on H-ZSM-5. The external mass transfer pattern was confirmed to be free of bed-depth effects, the intraparticle mass transfer resistance proved to be significant in the ammonia-TPD system, and equipment-related artefacts showed to be negligible based on preliminary experiments. Thus a consistent set of 10 TPD curves was collected, including two adsorption temperatures, three heating rates and two separate particle fractions. The experimental data was successfully modeled with a system including intraparticle mass transfer phenomena and intrinsic sorption kinetics. By combining a transient kinetic approach to a well-designed set of high-quality experiments vacuum-TPD can provide decoupled information on mass transfer and sorption for porous materials as we demonstrate in this work. (C) 2012 Elsevier Ltd. All rights reserved.
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