

Abstract Submitted  
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**On the Advective-Diffusive Mass Transport of Gas Mixtures**

ALEX JARAUTA, VALENTIN ZINGAN, PETER MINEV, MARC SECANELL,  
University of Alberta, DEPARTMENT OF MATHEMATICAL AND STATISTI-  
CAL SCIENCES, UNIVERSITY OF ALBERTA TEAM, ENERGY SYSTEMS  
DESIGN LABORATORY, DEPARTMENT OF MECHANICAL ENGINEERING,  
UNIVERSITY OF ALBERTA TEAM — Mass transport of gas mixtures often oc-  
curs in a variety of engineering applications, such as fuel cells and cooling towers.  
Classic approaches such as the advection-diffusion equation are limited to binary  
mixtures and diluted species in a mixture. Also, these theories have been shown to  
be unable to reproduce several phenomena occurring in capillaries or small pores  
[1], such as osmotic diffusion (i.e., diffusion without a concentration gradient), re-  
verse diffusion (i.e., diffusion in the direction of a positive concentration gradient),  
and diffusion barrier (i.e., no diffusion with a concentration gradient). The limita-  
tions of these classic models stem from the fact that only a mass-averaged velocity  
field is considered. In this work, a new multicomponent mass transport model was  
developed based on the work of Kerkhof and Geboers [1]. This model considered  
the velocity of each individual species, as well as an individual momentum equa-  
tion. The Stefan tube diffusion experiment was used to compare our model to the  
advection-diffusion equation. Partial viscosities and gradients of species velocities  
were identified as key parameters to overcome the limitations of the advection-  
diffusion equation. References: [1] P.J.A.M. Kerkhof and M.A.M. Geboers, *AICHE  
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Alex Jarauta  
University of Alberta

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