

Modification of Fick's First Law by Introducing the Time Delay

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Abstract : Fick's first law relates the diffusive flux to the concentration field, by postulating that the flux goes from regions of high concentration to regions of low concentration, with a magnitude that is proportional to the concentration gradient (spatial derivative). It is clear that the diffusion of flux cannot be instantaneous and should be some time delay in this propagation. But Fick's first law doesn't consider this delay which results in some errors especially when there is a considerable time delay in the process. In this paper, we introduce a time delay to Fick's first law. By this modification, we consider that the diffusion of flux cannot be instantaneous. In order to verify this claim an application sample in fluid diffusion is discussed and the results of modified Fick's first law, Fick's first law and the experimental results are compared. The results of this comparison stand for the accuracy of the modified model. The modified model can be used in any application where the time delay has considerable value and neglecting its effect reflects in undesirable results.

Keywords : Fick's first law, flux, diffusion, time delay, modified Fick's first law

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