

Mass diffusion in non-homogenous materials with application to drug delivery

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1. Abstract

The advance in material design has led to the rapid development of novel polymers with increasing complexity and functions in bioengineering. These materials have also been introduced for the development of drug releasing devices and systems. By today's micro-engineering potential, it is possible to fabricate and control the properties of the substrate to have the desired smart release properties and tailoring them for optimal drug administration including customizability. The effect of non-homogeneity represents an important feature that can influence greatly the release characteristics. Layer-by-layer and functionally graded materials are examples of composite materials in which properties vary from one region to another that are already currently and successfully used in a wide range of applications. In this talk we present a space-dependent diffusion-reaction model for drug releasing systems that extends the multi-layer configuration. Several possible space dependent forms for the diffusion and reaction shape-material functions are proposed. In a few cases a semi-analytical solution expressed in terms of Fourier series is possible. The drug concentration and release profiles show important differences with the uniform homogenous material case, providing guidance for design and development of micro-structure of polymer platforms for drug delivery.