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LEGENDRE, BESSEL AND BOUBAKER POLYNOMIALS THEORETICAL EXPRESSIONS OF LOW TEMPERATURE PROFILE IN A PYROLYSIS SPRAY MODEL: CASE OF GAUSSIAN DEPOSITED LAYER

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In this paper, a solution to heat equation in a spherical model is proposed. The model takes into account conjointly the boundary conditions and the transfer equations in a spray device. The deposited layer is supposed to be Gaussian and not uniform like most recent studies. The solution, using Legendre, Bessel and Boubaker polynomials expansions, presents the advantage of being continuous and indefinitely derivable. These features make the resolution connectable to any heat transfer similar model.

Keywords: Heat equation; boundary conditions; spray; heat transfer model; Legendre polynomials; Bessel polynomials; Boubaker polynomials.

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1. Introduction

Since 1990, several models have been recently proposed for spray pyrolysis set-up[1–5] as guides to deposited material composition prediction. Most of them were numerical or empirical.[3–6]

In this study, we propose an analytical solution to the heat transfer equation for the model of a pyrolysis spray device. The deposited layer is supposed to be Gaussian and the resolution is achieved in the spherical coordinate system.

2. The Gaussian Layer Model

Despite seeming experimentally uniform, a deposited layer solution does not have the same thickness on a targeted glass layer. Under experimental circumstances, the deposited material profile can be considered as Gaussian. Using the spherical coordinate system seems more appropriate (Fig. 1). The envelope of the layer in