SELF-SIMILAR PROBLEMS FOR THE MODELING

OF THE SURFACE CHEMICAL REACTIONS

TAKING INTO ACCOUNT THE GRAVITATION

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Abstract

The mathematical model of chemical reactions which are taking place on the surface of the uniformly moving glass fibre material, if it is pulled through bathes filled with acid solution, was constructed and partly numerically invastigated in our previous report [1].

The urgency of this investigation was caused by necessity to minimize substance of alkaline metal oxides in the glass fibre material and thus magnify its thermal strength.

The circumstance that the effect of gravitation was not taken into account, when this mathematical model was constructed, is causing certain objections. We now offerperfection of this mathematical model taking into account the effect of gravitation in the situation which is implied by vertically imbedded moving glass fibre material.

The partial differential equations of hydrodynamics and substances transport which were including in the mathematical model we transformed in the self-similar forms by two receptions using different changes of variables. In addition, we were applying Boussinesq's fitting of the density expression in order to simplify the system of ordinary differential equations.

The obtained self-similar problems were investigated qualitatively as well as numerically and received comparison was analyzed.

References

[1] Cepītis J., Kalis H. A certain mathematical model of the glass fibre material production. Progress in Industrial Mathematics at ECMI 96, Stutgart, Teubner, 1997, pp. 166-173.