Heat flow inside a catalyst particle for steam methane reforming: CFD-modeling and analytical solution

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Abstract

Numerical investigation of a steam methane reforming process was performed from point of view to understand the heat flows inside a catalyst particle. To verify the numerical results, a new method based on the thermal conductivity equation has been developed to determine the temperature distribution inside the catalyst particle. The CFD-model was realized via ANSYS Fluent. To model the steam methane reforming process, the industrial Ni-based catalyst with a spherical particle was chosen. The temperature contours inside the catalyst particle and hydrogen mole fraction in the reaction space was calculated both numerically and analytically. The results show the irregularity in the distribution of the temperature field inside the catalyst. In the direction of flow, a minimum catalyst temperature occurs. In this case, the temperature decrease inside the catalyst occurs unevenly. Also, the temperature change on the catalyst surface as a function of flow time was analyzed.

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