Summary of doctoral dissertation

Thesis title:	Solid foams morphology description and determination of momentum, heat and mass transfer coefficients.
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The results of morphology, flow resistance, heat and mass transport coefficients for nine solid metal foams with an open pore structure were presented, which was the purpose of this work. These parameters are necessary for using solid foams as a structured catalyst carriers: Foams morphology - including their geometric surface area, porosity, pores (cells and windows) and struts dimensions - were determined using X-ray computer microtomography Optical microscopy and helium porosimetry were also used to determine morphological parameters. An important problem of internal pores in the foam skeleton - both real and artifacts produced by the tomographic procedure - has been solved.

Experimental studies of air flow resistance in ambient conditions were performed; the results were compared with the work of other researchers, recommending the theoretical equation of Inayat et al. [74] for description the pressure drop in solid foams. The heat transfer coefficients were measured by heating the foams with high intensity electric current (up to 150 A) flowing directly through the foam skeleton; air and foam surface temperatures were measured with miniature thermocouples. The results were compared with the available literature and described by a correlation equation, using the foam strut diameter as the transverse dimension in characteristic numbers. Description of mass transport was obtained using the Chilton-Colburn analogy. The results confirmed the advanced thesis that flow and transport characteristics of solid foams depend on their morphology.

In order to determine the mechanism of gas flow and heat (mass) transport for foams, the flow around a submerged objects (a sphere or a cylinder) representing the foam skeleton, as well as developing laminar flow through a short capillary channel (foam pores model - cells and windows) were considered. Consideration of flow resistance alone did not provide a clear answer, which mechanism is correct.

Using the generalized Lévêque equation (GLE), both mechanisms ("flow around" and "flow through") were considered, determining flow resistance coefficients based on theoretical

relationships. It has been found that both the pressure drop and the heat/mass transfer for solid foams may be satisfactory described using the model of developing laminar flow in short capillary channel – the cell diameter of the foam – which length equals to the strut diameter.

This is the first one the literature describes the mechanisms of flow and transport for solid foams.