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An investigation of three-way catalytic converter for various inlet cone angles using CFD (Article)

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Abstract

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Three-way catalytic converters are utilized to minimize exhaust emissions. The efficient working of catalytic converter depends upon the flow field developed inside the converter. Due to the prevailing stringent norms, such as Bharat stage-VI, it is essential to create and design a high performing converter having uniform flow distribution within the converter to meet these norms. An easy way to gain an almost sufficiently homogeneous stream circulation is to compose the diffuser inclination minimally and correspondingly to manufacture the cone angle length long enough. The objective of the study is to examine an automobile catalytic convertor to present a detail and comprehensive report on the key parameters affecting the flow uniformity inside the converter and thus attempting to achieve minimum pressure drop across the converter to reduce the backpressure. They are modifying the existing geometry of the catalytic converter to have more uniform flow within the convertor. The analysis had been carried out with varying diffuser angles-57.3, 52.3, and 45 degrees separately. Simulation program using computational fluid dynamics (CFD) software package STAR CCM + 11.02 was used. The monolith design with a 52.3° cone angle evaluated with computations provides an actual parabolic curve, which gives a laminar flow within the catalytic converter, which in turn will increase the conversion efficiency of the converter by 1.060 %. The pressure drop within the monolith is also reduced by 3.7 Pa. This accounts to be a reduction in backpressure up to 5%, thus reduces brake specific fuel consumption of automobiles. The results are validated with the literature. The result shows the overall pressure drop augments with velocity. The temperature effect on light-off performance also studied.

SciVal Topic Prominence

Topic: Base Pressure | Mach Number | Convergent-divergent Nozzles

Prominence percentile: 85.885

Chemistry database information

Substances

Rh

Author keywords

Automotive catalytic converter | Diffuser angle | Flow index | Monolith diameter | Pressure drop

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