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A Study on the Performance Improvement of Zeolite Catalyst for Endothermic Reaction

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Abstract : In modern times, as flight speeds have increased due to improvements in aircraft and missile engine performance, thermal loads have also increased. Because of the friction heat of air flow with high speed on the surface of the vehicle, it is not easy to cool the superheat of the vehicle by the simple air cooling method. For this reason, a cooling method through endothermic heat is attracting attention by using a fuel that causes an endothermic reaction in a high-speed vehicle. There are two main ways of cooling the fuel through the endothermic reaction. The first is physical heat absorption. When the temperature rises, there is a sensible heat that accompanies it. The second is the heat of reaction corresponding to the chemical heat absorption, which absorbs heat during the fuel decomposes. Generally, since the decomposition reaction of the fuel proceeds at a high temperature, it does not achieve a great efficiency in cooling the high-speed flight body. However, when the catalyst is used, decomposition proceeds at a low temperature thereby increasing the cooling efficiency. However, when the catalyst is used as a powder, the catalyst enters the engine and damages the engine or the catalyst can deteriorate the performance due to the sintering. On the other hand, when used in the form of pellets, catalyst loss can be prevented. However, since the specific surface of pellet is small, the efficiency of the catalyst is low. And it can interfere with the flow of fuel, resulting in pressure loss and problems with fuel injection. In this study, we tried to maximize the performance of the catalyst by preparing a hollow fiber type pellet for zeolite ZSM-5, which has a higher amount of heat absorption, than other conventional pellets. The hollow fiber type pellet was prepared by phase inversion method. The hollow fiber type pellet has a finger-like pore and sponge-like pore. So it has a higher specific surface area than conventional pellets. The crystal structure of the prepared ZSM-5 catalyst was confirmed by XRD, and the characteristics of the catalyst were analyzed by TPD/TPR device.
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Keywords : catalyst, endothermic reaction, high-speed vehicle cooling, zeolite, ZSM-5
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