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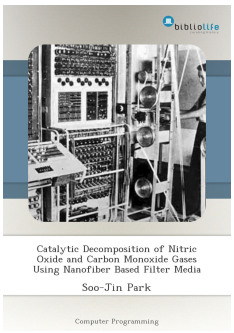
CATALYTIC DECOMPOSITION OF NITRIC OXIDE AND CARBON MONOXIDE GASES USING NANOFIBER BASED FILTER MEDIA EBOOKS 2019



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The main sources of NOx are diesel engines, automotives, electric utilities, other industrial, commercial, and residential sources that burn fuels at high temperature. The control and abatement of NOx emissions are important because of their harmful effects on the human body and the environment. The strict regulations of NOx emissions and the growing demand for power compel new design of catalytic materials for pollution removal. The most common method for car exhaust NOx treatment involves wet impregnation of noble metals on ceramic substrates. In this work, catalytic nanoparticles doped on nanofiber enhanced ceramic fibrous filter medium structure are developed as an alternative method. The noble metals, palladium, platinum and rhodium doped ceramic nanofibers, are synthesized using electrospinning and are incorporated into the micro-fibrous filter. We have discovered ceramic nanofiber containing noble metals also work in liquid phase catalysis by converting styrene to ethylbenzene at room temperature and atmospheric pressure. The reaction temperature is varied and the filters are tested for decomposition of nitric oxide and carbon monoxide using nanofiber based fibrous filter. Carbon dioxide, nitrogen and nitrous oxide gases were produced. Produced nitrous oxide gas was consumed by reacting with carbon monoxide. The efficiency of the catalytic fibrous filter was similar to commercial catalytic converter by adding of smaller amount of catalyst doped on alumina microfibers. As the amount of catalyst in the fibrous filter media increases the temperature at which all NO disappears decreases. As the inlet concentration of NO gas decreases, all NO disappears from the outlet at a lower temperature. As the face velocity through the fibrous filter media increases, efficiency becomes lower as the residence time of gases through the media decreases. We also tested a catalytic fibrous filter media containing Pd, Pt and Rh, and the performance is similar to that of catalytic convertor. Analytical models are developed to study the performance of filters for isothermal nitric oxide and carbon monoxide gas reaction. The kinetic parameters for the model were determined using the Genetic Algorithm (GA) computer program to determine species concentrations as a function of position. Model and experimental results showed that the decomposition temperature of nitric oxide gas decreases by lowering the inlet gas concentration and increasing of catalyst concentration in the nanofibers. Also a non-isothermal model was developed for direct nitric oxide decomposition to predict temperature and concentration profiles along the filter length. Advisors/Committee Members: Chase, George G.

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