Fabrication of doped Titania (TiO2) nanofibers to serve as catalysts in NH3-Selective CatalyticReduction (SCR)

Marani, Debora; Silva, Rafael Hubert ; Dankeaw, Apiwat; Gudik-Sørensen, Mads; Norrman, Kion; Kammer Hansen, Kent; Esposito, Vincenzo

Publication date:
2016

Document Version
Peer reviewed version

Fabrication of doped Titania (TiO_2) nanofibers to serve as catalysts in NH_3-Selective Catalytic Reduction (SCR)

Debora Marani, Rafael Hubert Silva, Apiwat Dankeaw, Mads Gudik-Sørensen, Kion Norrman, Kent Kammer Hansen, Vincenzo Esposito

Department of Energy Conversion and Storage, Technical University of Denmark (DTU)
Frederiksborgvej 399, Roskilde, DK-4000, Denmark

Abstract

In a context of significant interest for energy and environment, nanostructured-based ceramic materials are considered ideal candidates for the development of cost and energy efficient innovative systems. Such an attention is essentially due to the unique properties originating from the confinement of either one or more dimensions into the nanoscale level. Among others the large surface-to-volume ratio is a feature that greatly increases the reactivity of the nanomaterials towards gaseous species when compared with the non-nano dimensional materials. With this regards, catalysis is one of those applications that unquestionable benefits from this novel feature. In addition, when nanofibers (1D nanostructure) are used as catalysts, the further advantage of a self-supported wide open and well-interconnected porous structure is achieved.
Herein we demonstrate nanofibers as catalysts for the removal of the NOx in exhausts via the NH_3 Selective Catalytic Reduction (SCR) method. By combining electrospinning and sol-gel chemistry, materials are processed as nanofibers with the catalytic components (*e. g.* V_2O_5-WO_3) incorporated as dopants into the supporting anatase phase (*e. g* TiO_2). Remarkable high NOx conversion efficiencies are obtained and associated with the unique features deriving from the synergism among the doping approach, the nanoscale confinement, and the nano-fibrous texture. A novel concept of self-supported, lightweight and ultra-compact design SCR reactor is defined.