Coke resistant microstructure of NiO-GDC anode catalyst in direct methane fueled solid oxide fuel cells

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We developed a coated nickel catalysts for promoting a coke-tolerance in anode. Enhanced low-temperature solid oxide fuel cell was fabricated with this functional catalyst layer in anodes. Microstructural change being core-shell structure enhances the coking resistances as a result of the GDC shells protecting the coke-susceptible Ni surfaces. Furthermore, catalytic activities for CH_4 and CO oxidations also increased with core-shell like catalysts because of their structure expanding 2PB sites and nano-pores. This highly active anode catalayst layers which has benefits to prevent carbon formations induced by CO disproportionation at low temperatures boosts a durability of the low-temperature solid oxide fuel cells in dry methane. A powder density of this cell was 1.42 W cm^{-2} at 610 °C in dry methane and it operated over 1000 h at a current density of 1.2 A cm^{-2}. As a result, core-shell structural anode catalyst layer which is an effective design to enhance catalytic activities and avoid degradation with long-term operation is promising for low-temperature solid oxide fuel cells in CH_4.