Microstructure development of coke resistant internal reforming Ni-GDC anode catalyst in direct methane fuel cells

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We developed a coated nickel catalysts for enhancing a coke-tolerance in anode of low temperature solid oxide fuel cells. Microstructural change being core-shell structure in functional layer at the anode side enhances the coking resistances as a result of the GDC shells protecting the coke-susceptible Ni surfaces. Because of their structure expanding 2PB sites and nano-pores, catalytic activities for CH_4 and CO oxidations also increased with GDC coated catalysts. Highly active anode catalayst layer is beneficial to prevent carbon formations induced by CO disproportionation at low temperature and it boosts a durability in dry methane. A powder density of this cell was 1.42 W cm-2 at 610 oC in dry methane and it operated over 1000 h at a current density of 1.2 A cm-2. As a result, effective structure of core-shell like anode catalyst layer enhance catalytic activities and avoid degradation by long-term operation with CH_4.