Ni Catalyst to Reduce Carbon Coking for DIR-SOFC

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Direct internal reforming SOFC(DIR-SOFC) using steam reforming of methane has several merits such as heat utilization, less steam requirements, and high methane conversion. However, this system may cause coke formation on Ni surface resulting in catalyst deactivation and pluggin of reactor. To prevent this, excess amount of steam is applied lowering electrical efficiency. In this study, as an effort to overcome this problem, effective additives minimizing carbon coking under a low steam carbon to ratio is prepared. A Ni-YSZ with Potassium-containing additives was found to be an active and stable catalyst for steam reforming of methane in a steam to carbon ratio of 1.0 for SOFC application. 5~10wt% of Potassium titanates and perovskites were added to Ni-YSZ by physical mixing. The catalyst kept its activity for more than 100h at 1033K forming little coke on the catalyst (<1wt.%) while Ni-YSZ catalyst without any additives lost its activity quickly. Among potassium-containing additives, potassium dititanates, $K_2Ti_2O_5$, showed the best activity; as the contents of $K_2Ti_2O_5$ increased from 5wt.% to 10wt.%, the methane conversion increased from ~60% to ~70%.