# Optimal Sputtering Conditions for Nickel-Cermet Anodes in Intermediate Temperature Solid Oxide Fuel Cells

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**Abstract :** Nickel-Gadolinium Doped Ceria (Ni-GDC) cermet anodic thin films were prepared on Scandia Stabilized Zirconia (ScSZ) electrolyte supports by radio frequency (RF) sputtering, with a range of different sputtering powers (50 – 200W) and background Ar gas pressures (30 – 90mTorr). The effects of varying sputtering power and pressure on the properties of Ni-GDC films were studied using Focused Ion Beam (FIB), X-ray Photoelectron Spectroscopy (XPS), X-ray Diffraction (XRD), Energy Dispersive X-ray (EDX), and Atomic Force Microscopy (AFM) techniques. The Ni content was found to be always higher than the Ce content, at all sputtering conditions. This increased Ni content was attributed to significantly higher energy transfer efficiency of Ni ions as compared to Ce ions with Ar background sputtering gas. The solid oxide fuel cell configuration was completed by using lanthanum strontium manganite (LSM/YSZ) cathodes on the other side of ScSZ supports. Performance comparison of cells was done by Voltage-Current-Power (VIP) curves, while the resistances of various cell components were observed by nyquist plots. Initial results showed that anode films made by higher powered RF sputtering performed better than lower powered ones for a specific Ar pressure. Interestingly, however, anodes made at highest power and pressure, were not the ones that showed the maximum power output at an intermediate solid oxide fuel cell temperature of 800°C. Finally, an optimal sputtering condition was reported for high performance Ni-GDC anodes.

**Keywords :** intermediate temperature solid oxide fuel cells, nickel-cermet anodic thin films, nyquist plots, radio frequency sputtering
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