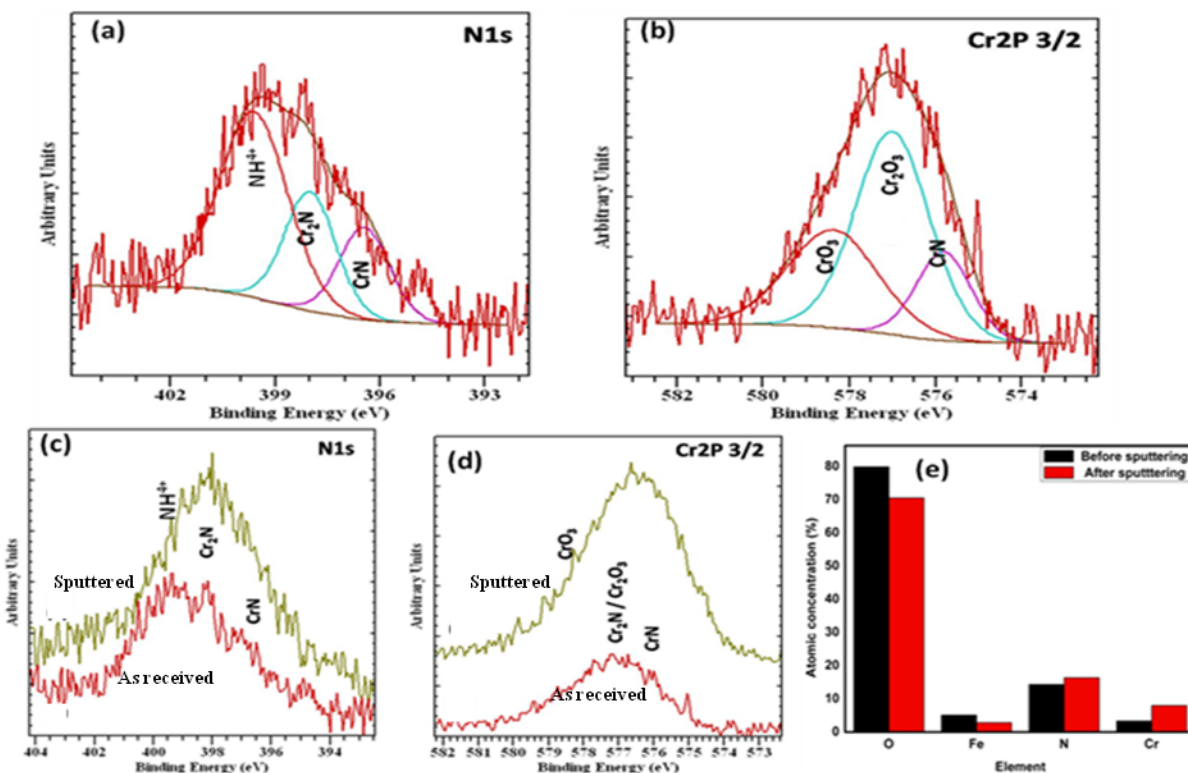


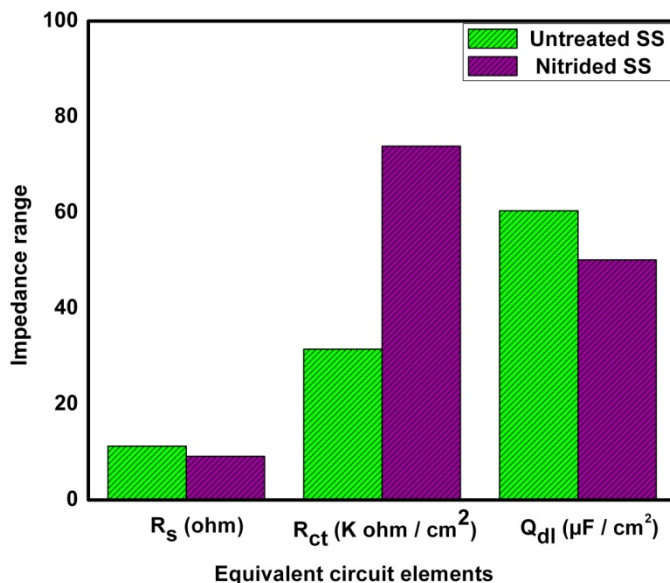
### Supplementary details:



**Fig. S1** Core level fitted XPS spectra of as received N1s and Cr2p 3/2 (a & b); as-received and sputtered (c & d) and (e) Atomic concentration of as received and after sputtered samples.

Fig. S1 in ESI shows the core level fitted XPS spectra of as received N1s and Cr2p 3/2 (a & b); as-received and sputtered (c & d) and (e) Atomic concentration and after sputtered samples. In the fitted curves of N1s spectra (Fig. S1(a)), the peak at 399.4 eV indicated the presence of  $\text{NH}_4^+$  on the surface, which is due to the reaction of adsorbed nitrate with aqueous solution of the electrolyte. The presence of  $\text{NH}_4^+$  and its binding energy agrees well with previous reports [1 - 3]. The peak at 396.8 eV indicates the formation of mixed nitrides with oxides, as a result of the applied negative potential and high cathodic charge [4 – 7]. Further, the presence of  $\text{NH}_4^+$  and nitrides is substantiated in Fig S1c. The binding energies at 396.6 and 397.5 eV revealed the formation of mixed nitrides viz. CrN and  $\text{Cr}_2\text{N}$  respectively. After sputtering, the surface  $\text{NH}_4^+$  was decreased. From the core level spectra of Cr2p (Fig. S1(d)), the peak at 575.8 eV indicates the formation of nitrides, which results from the electrochemical

nitridation based on the substrates and experimental conditions. The broad peak at 576.3 eV is related to the Cr- O bonding, it corresponds to  $\text{Cr}_2\text{O}_3$  and the binding energy at 576 eV corresponds to the formation of  $\text{CrO}_3$  [8, 9].



**Fig. S2 EIS parameters for Untreated and nitrided SS in PEMFC environment**

## References

- [1] H. Wang, G. Teeter, J. A. Turner, *J Mater. Chem.* 2011, 21, 2064.
- [2] G. T. Burstein, I. M. Huchings, K. Sasaki, *Nature.* 2000, **407**, 885.
- [3] D. Kim, C. R. Clayton, M. Oversluizen. *Mater. Sci. Eng.A.* 1994, **186**, 163.
- [4] C. R. Clayton, G. P. Halada, J. R. Kearns. *Mater. Sci. Eng.A.* 1995, **198**, 135.
- [5] C. C. Huang, W. T. Tsai, J. T. Lee. *Corros. Sci.* 1995, **37**, 769.
- [6] C. Palacio, A. Arranz, D. Díaz. *Thin Solid Films.* 2006, **513**, 175.

[7] P. Marcus, M. E. Bussell. *Appl. Surf. Sci.* 1992, **59**,7.

[8] J. P. Riviere, M. Cahoreau, P. Meheust. *J. Appl. Phys.* 2002, **91**, 6361.

[9] M. K. Lei, X. M. Zhu. *J. Electrochem. Soc.* 2005,**152**, 291.