Electronic Supporting Information

Structural characteristics and catalytic performance of alumina-supported nanosized ceria-lanthana solid solutions

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Fig. S1. TEM micrographs of (A) 773 K and (B) 1073 K calcined alumina supported ceria-lanthana (CLA) samples.

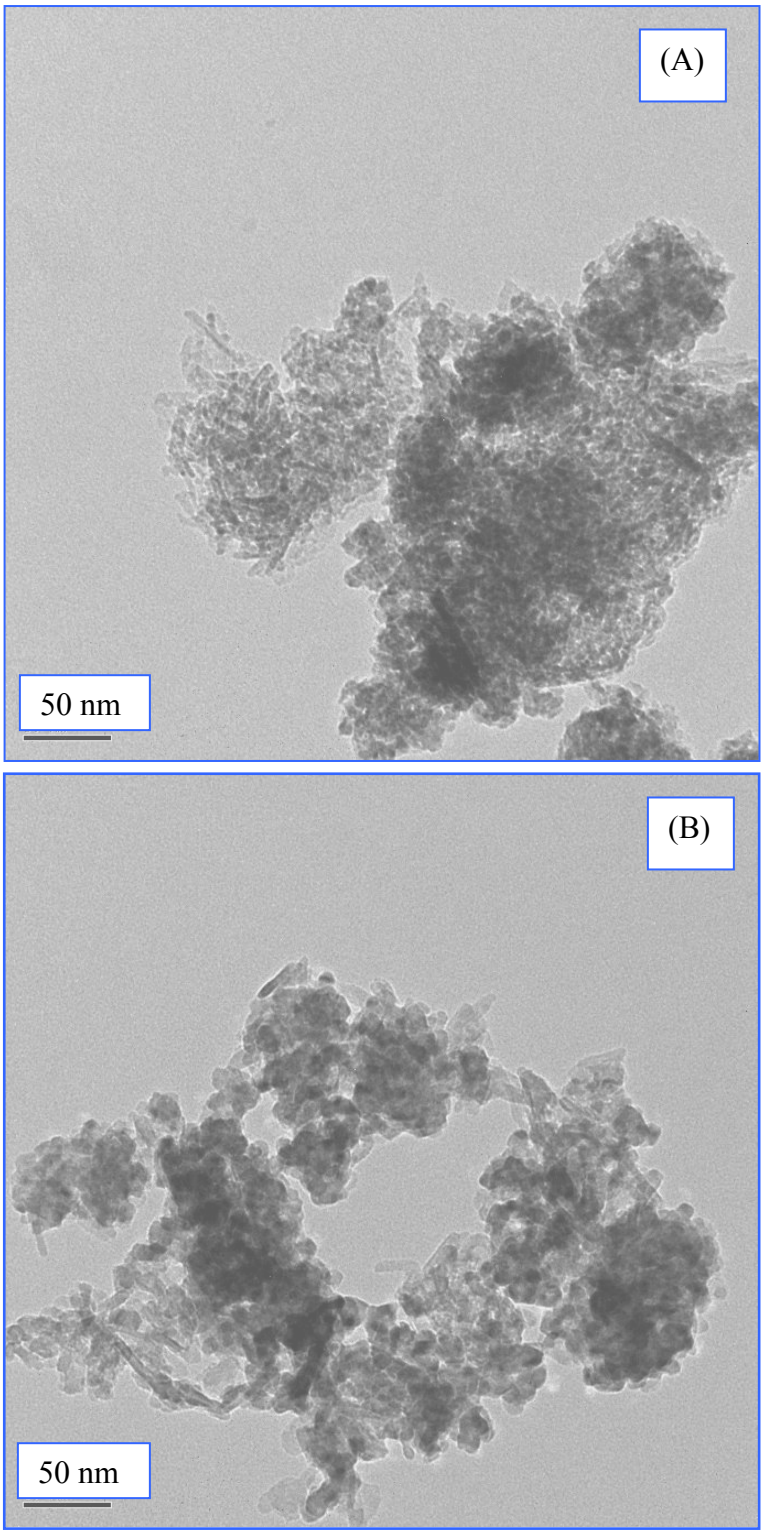
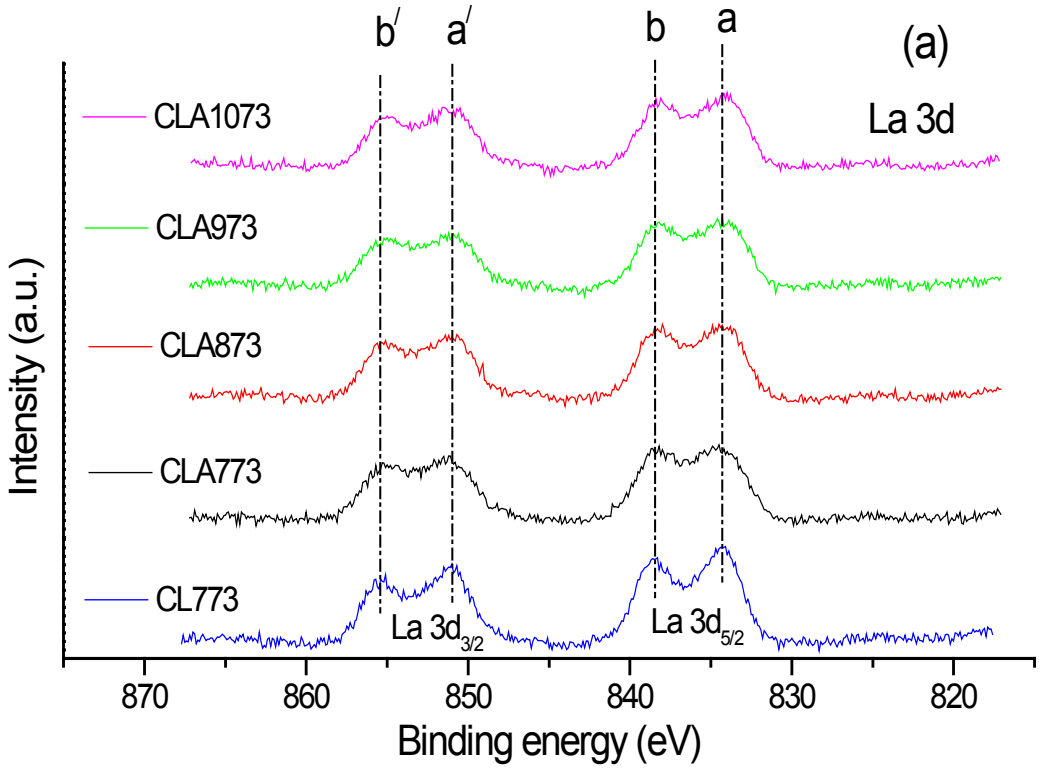
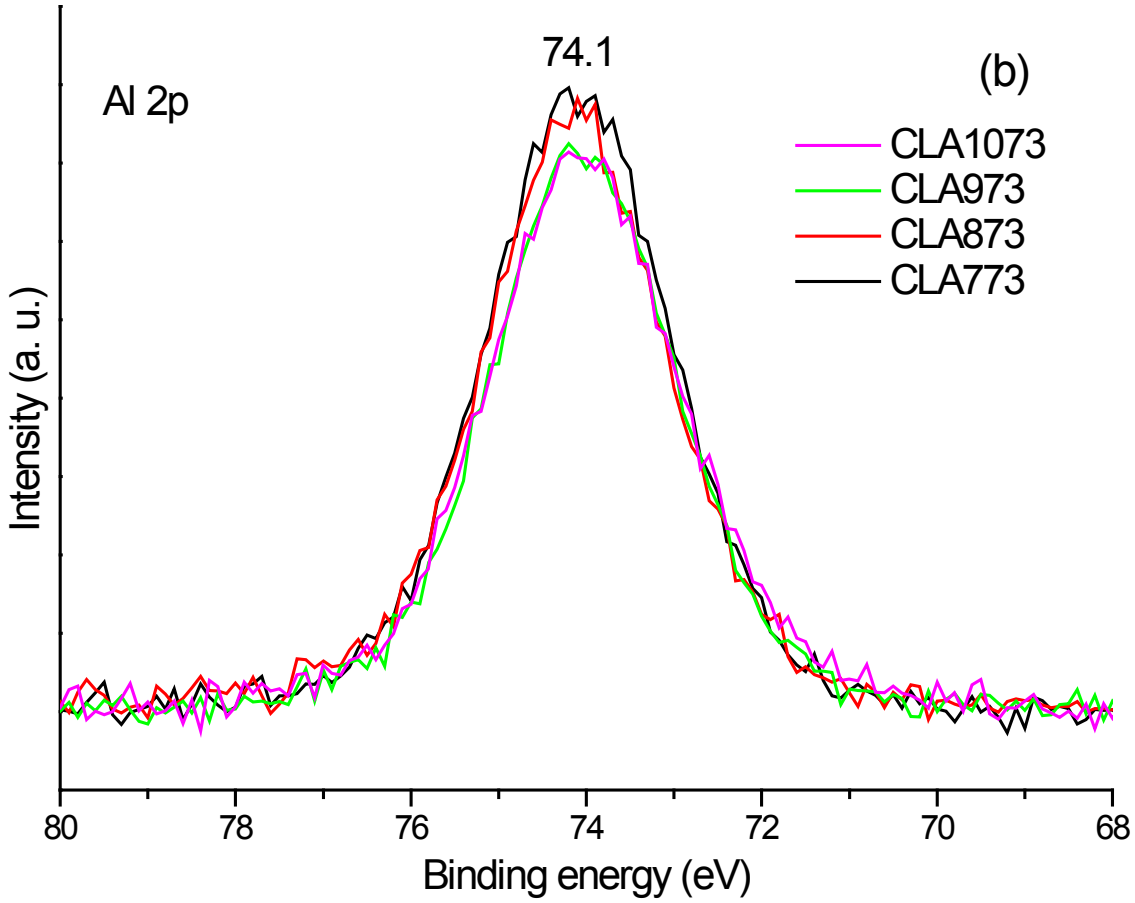


Fig. S2. (a) La 3d XPS patterns of alumina supported ceria-lanthana (CLA) (the components a, a′ are main peaks and b, b′ are shake up satellites) calcined at various temperatures from 773 to 1073 K and ceria-lanthana (CL 773), and (b) Al 2p XPS patterns of alumina supported ceria-lanthana (CLA) calcined at various temperatures from 773 to 1073 K.





The double splitting La 3d core level spectra of CLA sample is presented in the Fig. S2 (a). For comparison purpose, CL 773 sample spectrum is also shown. The first split is due to spin–orbit interaction denoted by 'a' and 'a$^{/}$'. The additional split is due to the transfer of an electron from the oxygen ligands to the empty La 4f level and is observed at 4.3 eV away from the former peak.[S1] The La 3d core level peak cannot be distinguished whether it is from the solid solution formed by ceria and lanthana or it is from perovskite ($LaAlO_3$) as both are observed approximately in the same region with negligible difference. The binding energy of La 3d is not changed within the investigated temperature range. However, the main peak intensity of CLA's La 3d is slightly decreased compared to the CL and further gradually decreased with increase in the calcination temperature. The Al 2p core level peak is shown in the Fig. S2 (b). The peak is relatively broad indicating alumina is not easily accessible at the surface due to the presence of the active component over it. The Al 2p of $LaAlO_3$ perovskite also shows the peak at the same region.[S2] Variation in the calcination temperature is preceded by a decrease in the intensity as well as the width of the peak. The decrease in the intensity of both La 3d main peak and the Al 2p is probably due to solid phase interaction of the La with the Al.

Fig. S3. Ce 3d XPS patterns of ceria (C 773), alumina supported ceria (CA 773) and alumina supported ceria-zirconia (CZA 773).

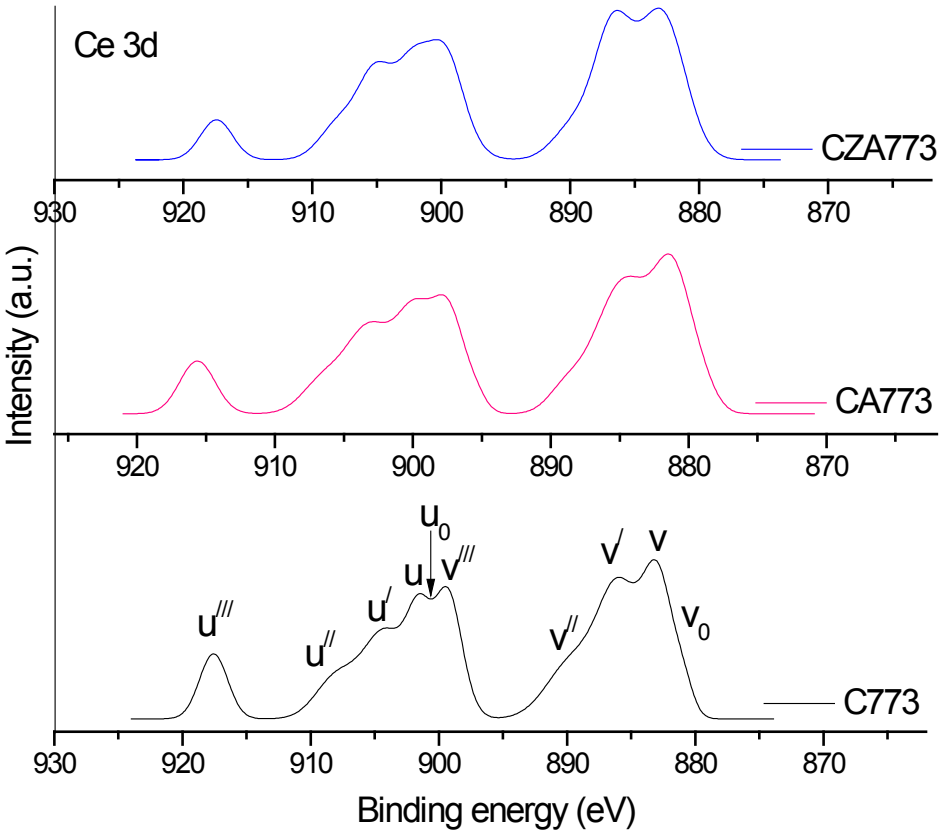
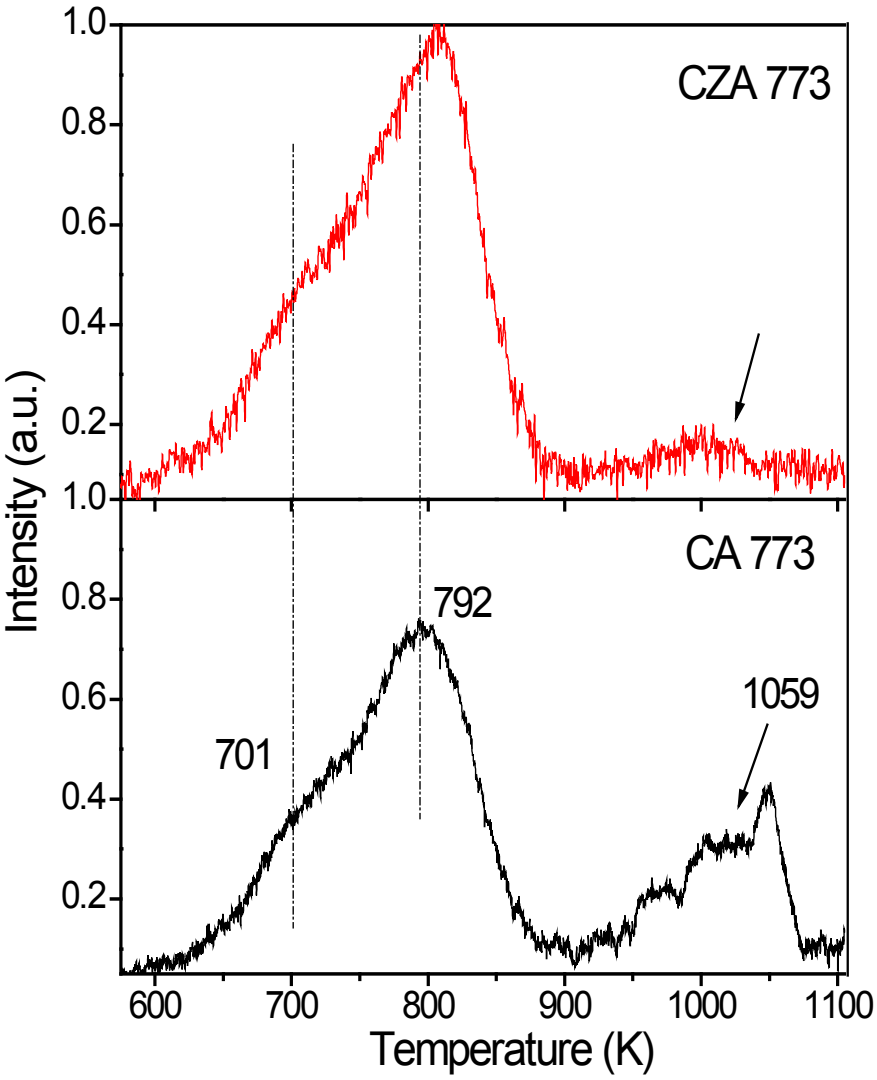


Fig. S4. TPR patterns of alumina supported ceria (CA 773) and alumina supported ceria-zirconia (CZA 773).



References

S1 C. N. Zhang Borca, S. Canulescu, F. Loviat, T. Lippert, D. Grolimund, M. Döbeli, J. Wambach, A. Wokaun, *Appl. Surf. Sci.* 2007, **254**, 1352−1355.

S2 X. L. Li, W. F. Xiang, H. B. Lu, Z. H. Mai, *J. Appl. Phy*. 2005, **97**, 124104-4.