Profound Understanding of Effect of Transition Metal Dopant, Sintering Temperature and pO_2 on the Electrical and Optical Properties of Proton Conducting $BaCe_{0.9}Sm_{0.1}O_{3-\delta}$

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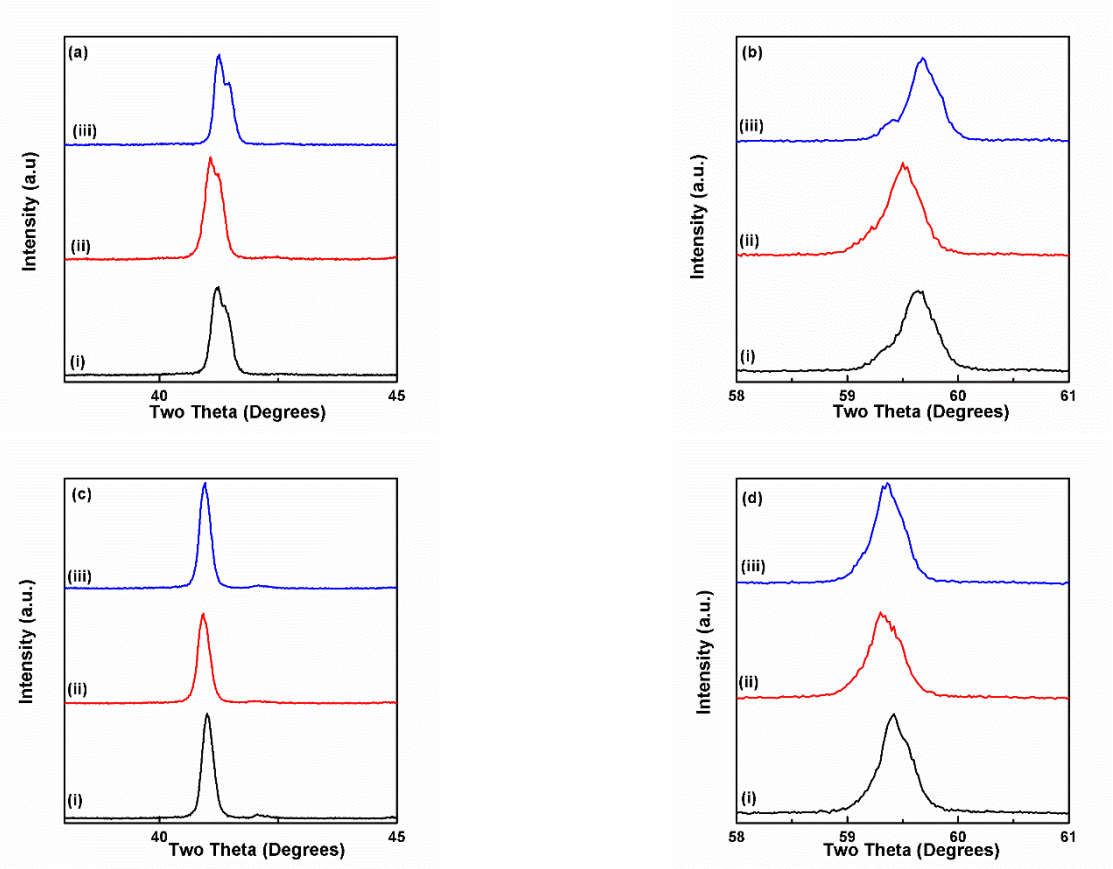
Supporting Information



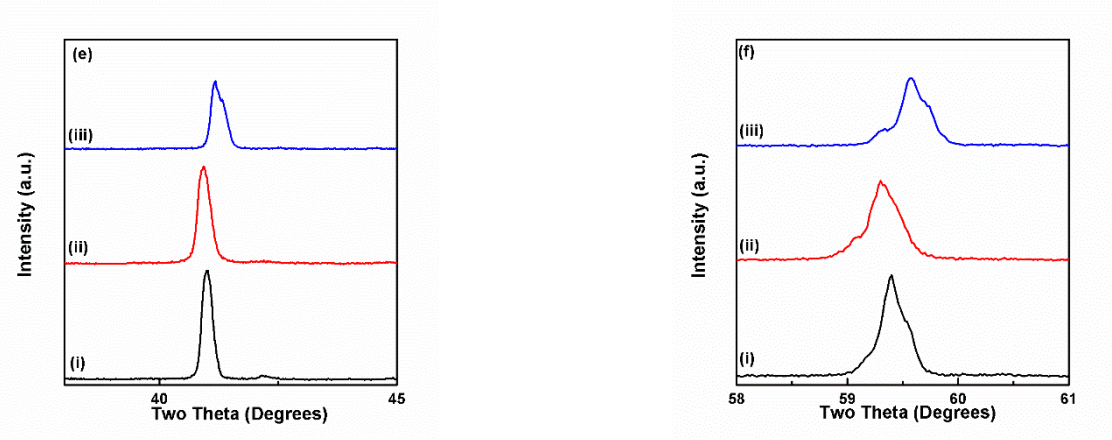


Figure S1. Magnified PXRD peaks at (400) and (132) for the two theta between 38-45 ^{o} and 58-61^{o} of (a,b) $BaCe_{0.9}Sm_{0.1}O_{3-\delta}$ (BCS), (c,d) $BaCe_{0.85}Sm_{0.1}Fe_{0.05}O_{3-\delta}$ (BCSF), and (e,f) $BaCe_{0.85}Sm_{0.1}Co_{0.05}O_{3-\delta}$ (BCSC) samples sintered at 1200^{o}C for 8h and followed by annealing in (i) air, (ii) N_2+3%H_2O and (iii) dry H_2 at 1000 ^{o}C/1h.

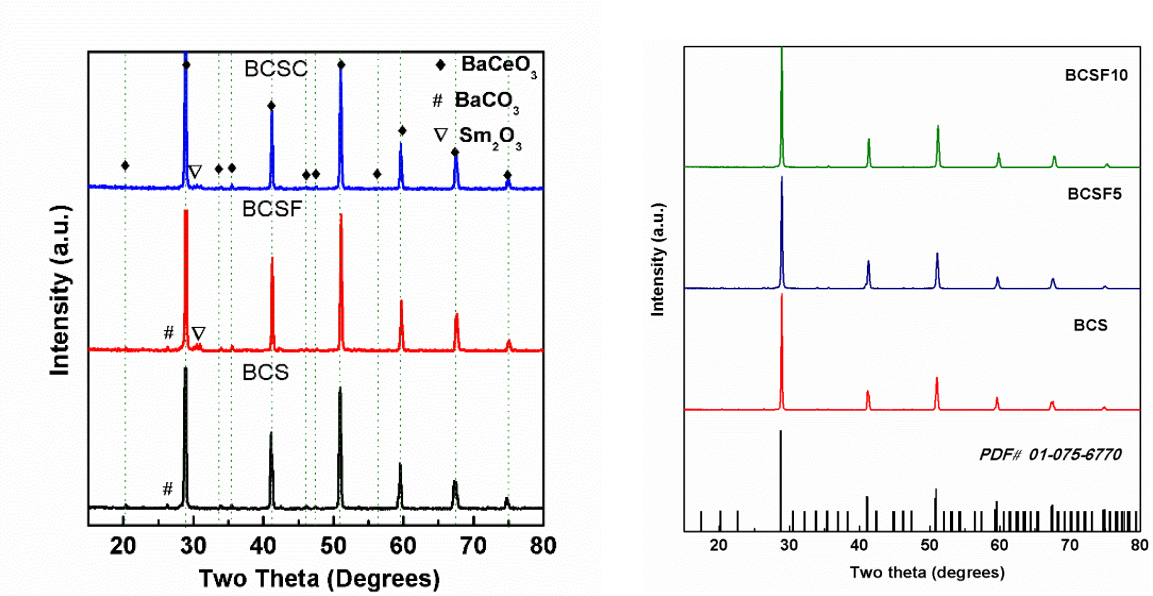


Figure S2. XRD patterns of samples sintered at (l.h.s.) 1300 ^{o}C/8h for $BaCe_{0.9}Sm_{0.1}O_{3-\delta}$ (BCS), $BaCe_{0.85}Sm_{0.1}Fe_{0.05}O_{3-\delta}$ (BCSF), and (c) $BaCe_{0.85}Sm_{0.1}Co_{0.05}O_{3-\delta}$ (BCSC), and (r.h.s.) 1400 ^{o}C/8h in ambient air for $BaCe_{0.9}Sm_{0.1}O_{3-\delta}$ (BCS), $BaCe_{0.85}Sm_{0.1}Fe_{0.05}O_{3-\delta}$ (BCSF5); $BaCe_{0.8}Sm_{0.1}Fe_{0.1}O_{3-\delta}$ (BCSF10). Phases have been recognized and indexed according to the corresponding PDF card.

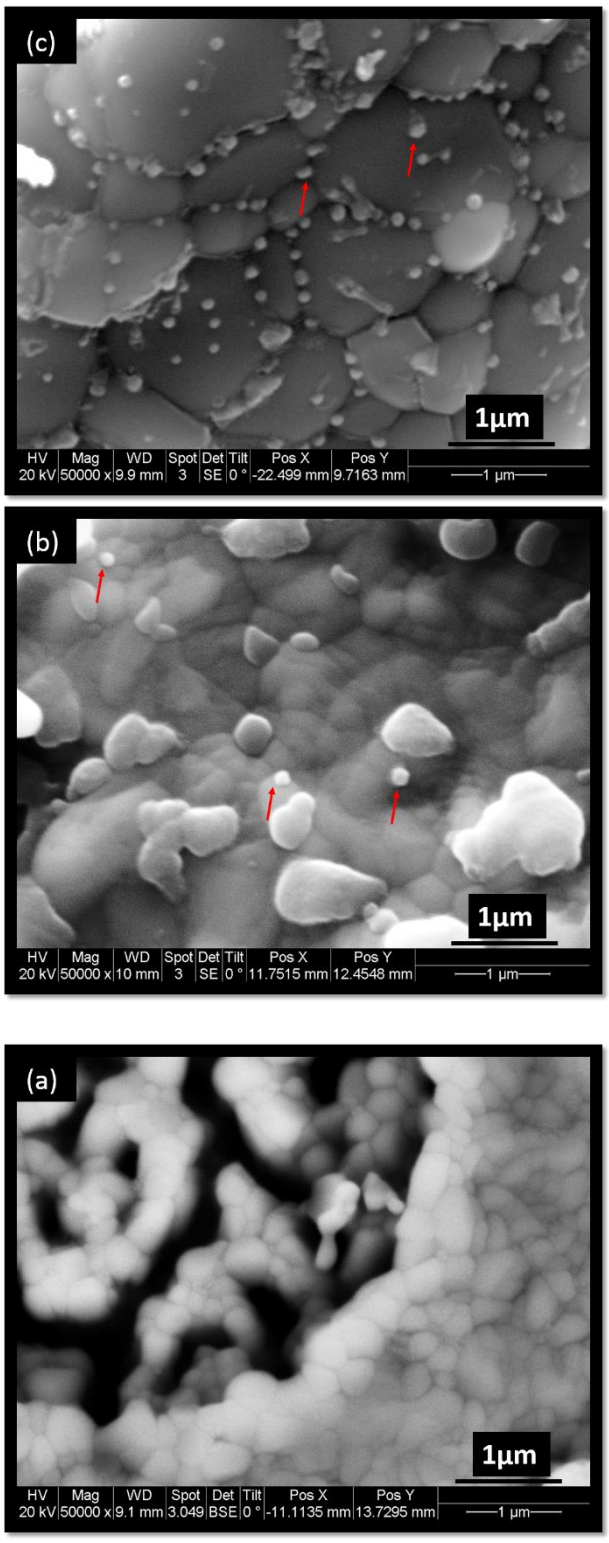


Figure S3. SEM images of (a) $BaCe_{0.9}Sm_{0.1}O_{3-\delta}$ (BCS) (b) $BaCe_{0.85}Sm_{0.1}Fe_{0.05}O_{3-\delta}$ (BCSF5) and (c) $BaCe_{0.85}Sm_{0.1}Co_{0.05}O_{3-\delta}$ (BCSC5) powder samples sintered at 1200 ^{o}C /8h in air and subsequently reduced in dry H_2 at 1000 ^{o}C/1h.

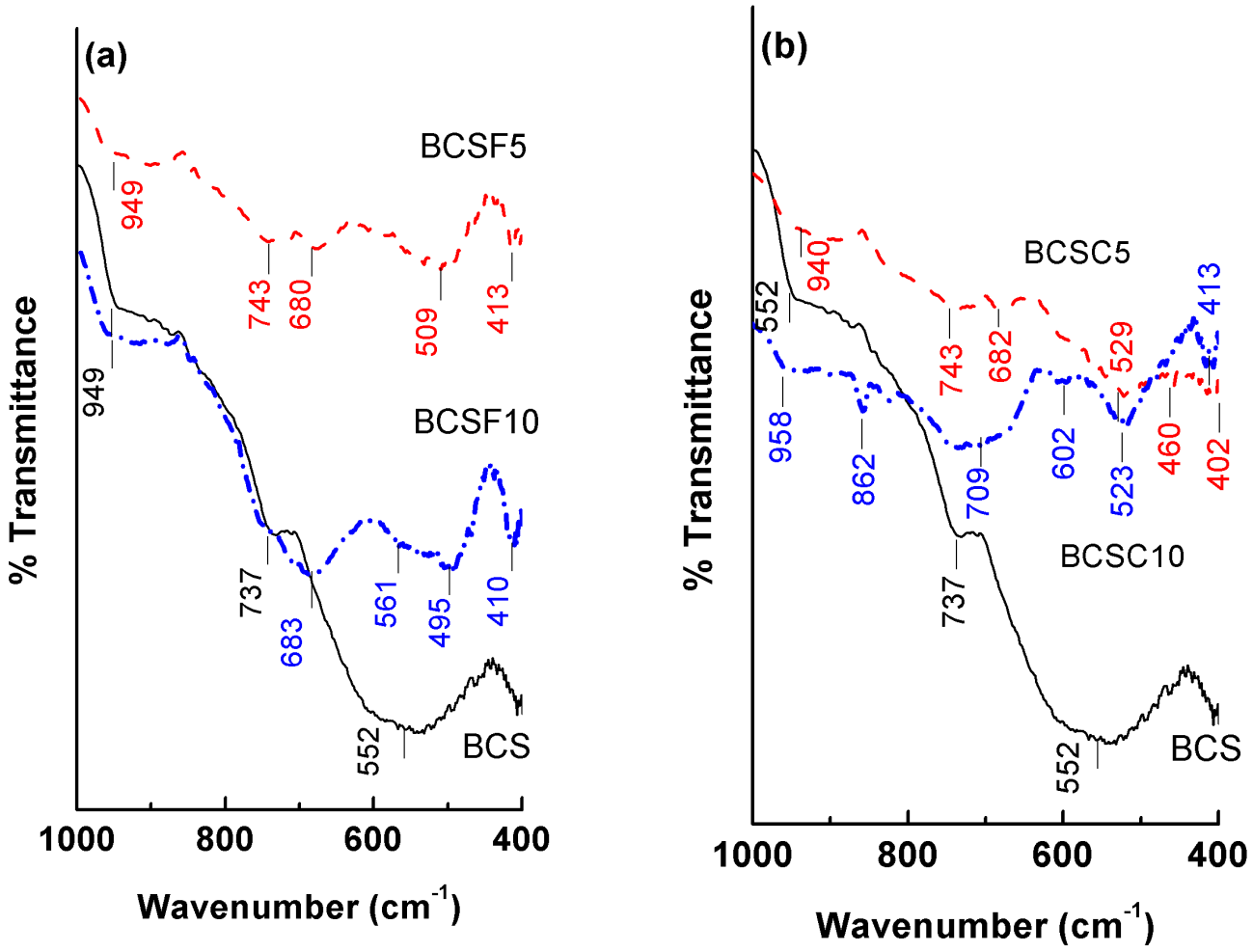


Figure S4. Room temperature FTIR in the region 1000- 400cm^{-1} of (a) $BaCe_{0.9}Sm_{0.1}O_{3-\delta}$ (BCS), $BaCe_{0.85}Sm_{0.1}Fe_{0.05}O_{3-\delta}$ (BCSF5), $BaCe_{0.8}Sm_{0.1}Fe_{0.1}O_{3-\delta}$ (BCSF10) and (b) $BaCe_{0.9}Sm_{0.1}O_{3-\delta}$ (BCS), $BaCe_{0.85}Sm_{0.1}Co_{0.05}O_{3-\delta}$ (BCSC5), $BaCe_{0.8}Sm_{0.1}Co_{0.1}O_{3-\delta}$ (BCSC10) sintered powders at 1400 ^{o}C/8h.

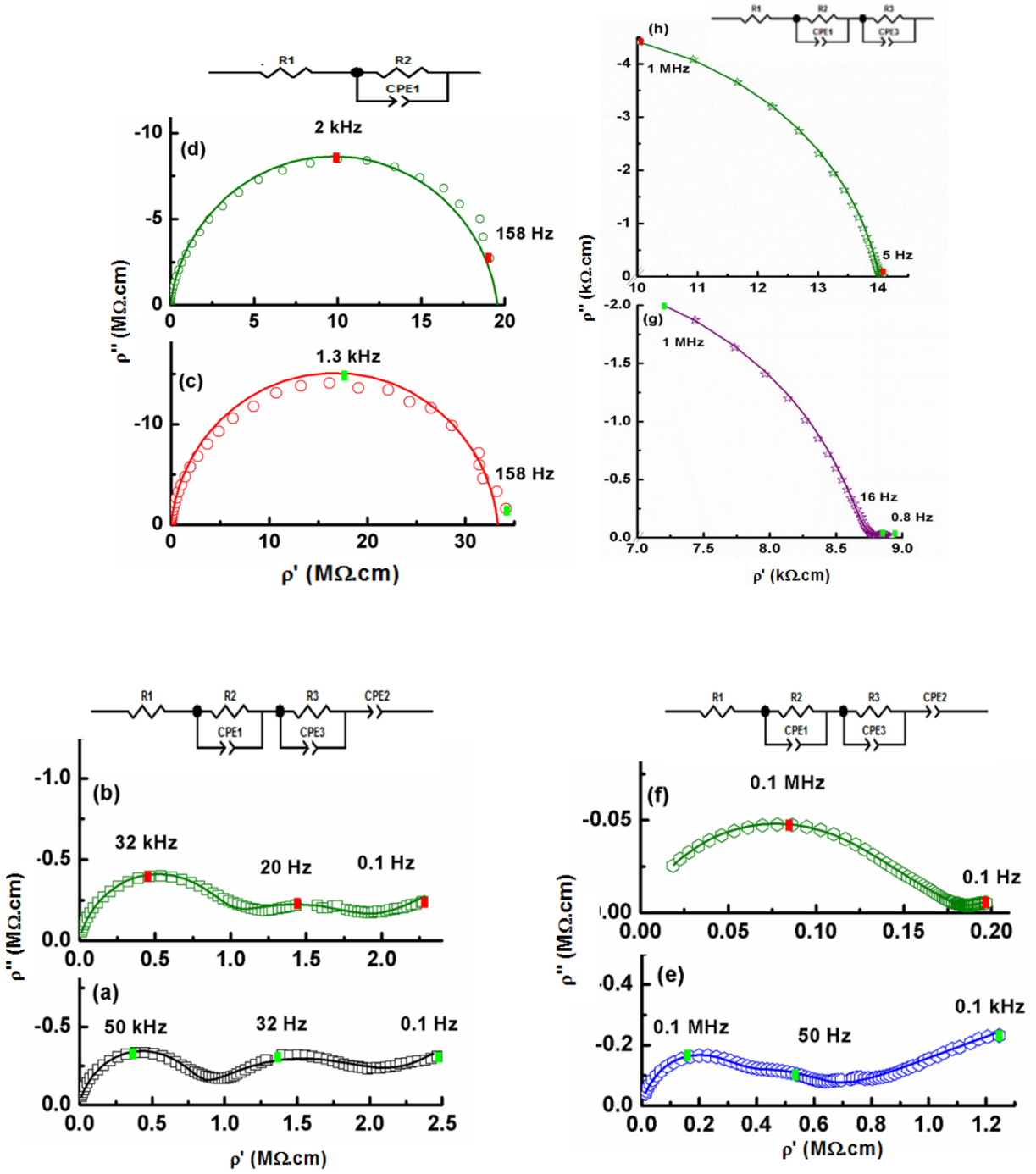


Figure S5. Impedance spectra of the 1400 ^{o}C sintered pellets that have the composition of (a,b) $BaCe_{0.85}Sm_{0.1}Fe_{0.05}O_{3-\delta}$ (BCSF5), (c,d) $BaCe_{0.8}Sm_{0.1}Fe_{0.1}O_{3-\delta}$ (BCSF10), (e,f) $BaCe_{0.85}Sm_{0.1}Co_{0.05}O_{3-\delta}$ (BCSC5), and (g,h) $BaCe_{0.8}Sm_{0.1}Co_{0.1}O_{3-\delta}$ (BCSC10) measured at 90 ^{o}C in air, and H_2 + 3%H_2O, respectively. The solid line represents the best fit from applying the corresponding equivalent circuit. All the plots were normalized to both the area and the thickness.