A novel solid oxide cell concept, named as redox solid oxide cell, is proposed in this work. To demonstrate the concept, solid oxide cells with doped-SrTiO3 fuel electrodes and modified NiO-3YSZ fuel electrode support were developed to realize the redox-stable solid oxide cells. By modifying the particle characteristics of NiO, 3YSZ, slurry composition and sintering profile, a redox stable and multifunctional NiO-3YSZ fuel electrode support was successfully developed. Furthermore, two different types of doped-SrTiO3 (Sr0.94Ti0.9Nb0.1O3 and La0.49Sr0.31Fe0.03Ni0.03Ti0.94O3) fuel electrode materials were successfully integrated in to the half-cells with redox stable NiO-3YSZ support. Defect free solid oxide cells of 12 cm × 12 cm size were fabricated. The redox stability of these cells was evaluated and compared with the state-of-the-art NiO-3YSZ solid oxide cells at 850 °C. It was clearly demonstrated that the newly developed redox solid oxide cells have superior stability compared to the state-of-the-art cells. In order to establish the potential of the newly developed redox solid oxide cells, the evaluation of the electrochemical performance is required.