Highly active Ruddlesden-Popper material with in situ exsolved Co nanoparticles for catalyst for CO_2 electrolysis

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We report a highly active Ruddlesden-Popper material with in situ exsolved Co nanoparticles and its use as an effective catalyst for CO_2 electrolysis to produce CO in solid oxide electrolysis cell (SOEC). This catalyst was obtained by transforming a perovskite of $(La,Sr)(Co,Mn)O_3$ under the reducing condition and revealed a good reversibility of structural transition between the Ruddlesden-Popper and the perovskite structure during reaction cycles. An outstanding current density of 630 mA/cm^2 was accomplished at a voltage of 1.3 V and temperature of 850 ºC with a high Faraday efficiency of 97.4%. In addition, no sign of degradation was exhibited as observed by galvanostatic stability test. In situ exsolved Co nanoparticles and high concentration of oxygen vacancies caused by the structural transition are responsible for its high stability and electrochemical performance. Therefore, this in situ exsolved Co nanoparticles on Ruddlesden-Popper material can be used as a promising cathode material for CO_2 electrolysis.