Composition-Performance Relationship of Er-Modified Bimetallic $CeVO_4$ Solid Solutions Active in NO_X Reduction at High Temperatures

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Metal oxide nano-composites to catalyze NO_X reduction with NH_3 (SCR) show severe drop in NO_X conversions/N_2 selectivities at elevated temperatures. This is mainly responsible for Lewis acid sites (LA) indigenous to metal oxides. In addition, LA strengths of metal oxides do not allow for the facile liberation of NH_3 species adsorbed on the surfaces at high temperatures. As a way to detour major concerns stated above, here we synthesize $CeVO_4$ and its Er-modified bimetallic analogues ($Ce_{1-X}Er_XVO_4$) with variable Er compositions. $Ce_{1-X}Er_XVO_4$ (Er_X) solid solutions are iso-structural and thus can minimize the geometrical effect on the consequences during SCR and NH_3 oxidation. $Er_{0.5}$ is verified to provide the greatest amounts of LA and redox sites. This leads to the best SCR consequences of $Er_{0.5}$ among all Er_X solid solutions studied. Such desired catalytic trait provided by $Er_{0.5}$ is retained even post hydro-thermal aging. This study validates the control over the composition of metals used to construct bimetallic vanadates is of great viability to promote SCR performance at high temperatures.