While point defects have been well studied in energy conversion ceramics by exploiting non-isovalent lattice substitutions and non-stoichiometric compounds, the impact of multidimensional defects on catalytic activity and stability is far less studied. During activation, energy conversion catalysts often go through phase transitions, such as exsolution. These transitions can either be beneficial or detrimental to performance. We observe that extended defects critically impacts the temperature at which such phase transitions can occur, the pathway of the phase transition, and resulting catalytic activity and stability of the catalyst. Here, we describe how extended defects such as stacking faults in substituted lanthanum nickelates and lanthanum ferrates can be exploited to significantly extend catalyst lifetimes and lower apparent activation energy for critical reactions such as methane and carbon monoxide oxidation. Finally, we describe how differential metal-oxygen bond strengths within nonstoichiometric ceramic nanoparticles can be used to tailor the structure of catalytic active sites and dramatically improve metal dispersion.