

Table S1 A comparison between the advantages and disadvantages of each synthesized method for double perovskite oxides

Synthesized method	Advantages	Disadvantages
Solid-state reaction (SSR) method	convenient, low-cost, and a potential for large scale production	Unable to achieve uniform mixing at the atomic level, easy agglomeration, and unable to precisely control the composition of the material
Molten salt synthesis (MSS) method	uniform particle size, well-defined crystal structure, controlled morphology and stoichiometry, low cost, high yield and quality, industrial production, universal applicability	The samples after low-temperature calcination must be cleaned with deionized water to remove excess salts, which can easily cause resource waste and increase costs
Combustion method	energy-saving and high reaction rates, simple equipment, low raw material costs, and the ability to achieve uniform mixing of reactants at the molecular level, easy to control the product composition	difficult to precisely control the combustion mode, and the controllability of the combustion process is poor. difficult to control the morphology of combustion products, unpredictable combustion characteristics
High-pressure (HP) synthesis	tuning rapidly, shortening the synthesis time, simplifying procedures, large-scale production, one-step and intercepting high-pressure properties to ordinary pressure	High equipment cost, high technical difficulty, and poor safety performance
Sol-Gel method	good chemical uniformity, cost-effectiveness, fine particles, high purity, simple equipment, and high powder activity	long processing time, poor repeatability, and the consumption of a large amount of organic reagents, relatively high cost and not suitable for large-scale industrial production
Hydrothermal method	high purity and crystallinity, symmetrical particle distribution, controlled size and morphology	high equipment cost, low reaction safety, and low output
Coprecipitation methods	simpler process, lower reaction temperature, shorter reaction and aging time in production and the advantages of lower cost and higher profits concerning markets	large particle size, wide distribution, poor morphology, and easy to produce coprecipitation of other impurities
Electrostatic spinning	a simple, convenient experimental setup. large-scale and efficient preparation of perovskite inorganic nanofibers with high aspect ratios	High voltage required, high energy consumption, difficult to collect liquids, supercritical fluid as a plasticizer required