Material design and performance regulation of Ru-based electrocatalysts for hydrogen production

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The proposal of the carbon peak and carbon neutrality goals will inevitably accelerate energy transformation, which means a transformation from high-carbon to low-carbon, and the rapid development of hydrogen energy will inevitably take on the important mission of achieving carbon neutrality. Mastering the large-scale preparation technology of hydrogen fuel cell electrocatalysts is the key to achieving efficient conversion and storage of electrochemical energy, and it is also an urgent scientific problem to be solved. Facing the major strategic needs, we have been working on the international frontier scientific issue of hydrogen energy production and storage system, and have achieved a series of innovative research results in the design and regulation of key materials for ruthenium-based electrocatalysts. We used surface modification strategy to design heterogeneous structures to change the atomic structure of the interface region, thereby accelerate the migration rate of electrons and ions, and improve the elementary process of electrochemical reactions [1-4]; Applied the doping strategy to regulate the atomic and electronic structure of the bulk catalyst, regulate the local coordination environment, defects, and adsorption energy of intermediate products, accelerate the electrocatalytic kinetic process [5]; Achieved the dual modification of catalyst by bulk doping and surface modification simultaneously, which achieving the purpose of stabilizing the structure of material and improving the performances, and applied this material to energy fields such as hydrogen production [6]. The above regulation strategies are highly universal, which provides the promising routes for designing electrocatalysts that maintain high catalytic activity under high current density, and are bound to offer valuable references for building a clean, low-carbon, safe and efficient modern energy system.

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