Electrochemical deposition of mesoporous high-entropy Pt-Pd-Rh-Ru-Cu-Au-Se-Mo films

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Bottom-up approaches have been widely used to design nanoarchitectured metallic materials for various applications such as catalysis and biosensors. High-entropy materials (HEMs), characterized by their high configurational entropy, provide numerous active sites for complex multielectron reactions, which enhances catalytic performance.[1] However, conventional methods for synthesizing nano-sized HEMs often require high-temperature calcination or environmentally unfriendly organic solvents. For the first time, we have synthesized mesoporous high-entropy metal films using a predominantly aqueous-based room-temperature electrodeposition method.[2] It is crucial to assemble more metallic elements arbitrarily and to study the effects of different synthesis conditions on composition and entropy, which is rarely reported.

In this study, we developed a mesoporous high-entropy metal chalcogenides film containing eight elements (Pt, Pd, Rh, Ru, Cu, Au, Se, and Mo) through a soft-template-assisted electrochemical reduction method (**Fig. 1**). We found that altering the electrodeposition potential can regulate the metal composition and entropy, with the maximum entropy value reaching 1.95*R*. This value represents the highest reported for mesoporous metal-based materials to date. The uniformly distributed mesopores contribute to a substantial increase in surface area, facilitating enhanced catalytic activity. Our method, coupled with the use of a cost-effective carbon paper substrate, not only addresses economic challenges but also provides a platform for fabricating a wide range of HEMs with tailored properties.

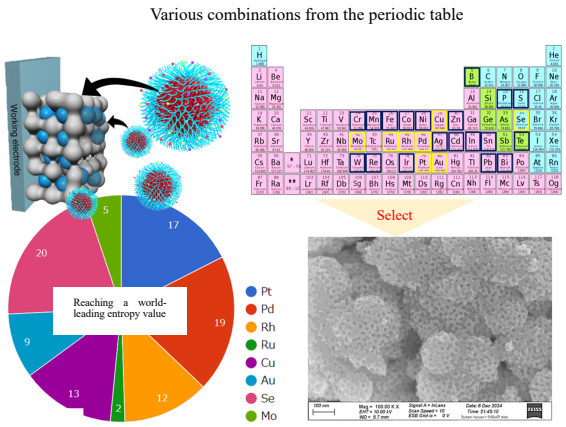

Fig. 1 Synthesis mechanism, elemental selection, molar ratios, and SEM image of high-entropy Pt-Pd-Rh-Ru-Cu-Au-Se-Mo.

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