Study on High-efficiency Synthesis of Metallic Materials

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Abstract: With the continuous development of modern organ metallic materials, the synthesis and performance optimization of metal materials are constantly developed. Metal is a kind of material with a long history in basic research and industrial application. It has known that the properties and functions of metals have closely related to their size, shape, structure and composition. In this paper, the synthesis of bimetallic nonmaterials will study.

1. Development history of metal materials

Materials mark the development of human society. Historically, materials have regarded as milestones in the evolution of human society. The ability to understand and use materials determines the form of society and the quality of human life. Historians also use materials and their utensils as symbols of the era: Stone Age, Bronze Age, Iron Age, Polymer material Age, etc. 1 million years ago, primitive people used stone as a tool. It called the Paleolithic Age. 10,000 years ago, humans processed stone tools into utensils and exquisite tools, thus entering the Neolithic Age. Now archaeological excavations prove that our country has been in China for more than 8,000 years. It has made into practical pottery, brass has smelted more than 6,000 years ago, simple bronze tools have made more than 4,000 years ago, and weapons have been made of meteorite iron more than 3,000 years ago. Our ancestors smelting pig iron more than 2500 years ago in the Spring and Autumn period, more than 1800 years earlier than in Europe. In the 18th century, the development of the iron and steel industry became an important content and material basis of the industrial revolution. In the middle of the 19th century, with the emergence of modern open-hearth and converter nickel tube steelmaking technology, human beings have really entered the iron and steel age. At the same time, copper, lead, zinc is also widely used, aluminum, magnesium, titanium and other metals have published and applied. Until In the middle of the 20th century, metal materials have always occupied a dominant position in the material industry. After the middle of the 20th century, science and technology have developed rapidly, and new materials, as the mother of invention and industrial grain, have undergone epoch-making changes.

First, synthetic polymer materials came out has been widely used for only half a century. Polymer materials have been neck and neck with metal materials with a history of thousands of years, and the volume of annual output has exceeded that of steel, becoming the national economy. Secondly, Ceramics are the first materials made from raw materials provided by nature. In the 1950s, with the development of synthetic chemical raw materials and special preparation technology, ceramic materials made a leap, resulting in the transformation from traditional ceramics to advanced ceramics. Many new functional ceramics have formed an industry. Nowadays, according to the different chemical composition, people also divide the materials into three categories: metal materials, inorganic non-metallic materials and organic polymer materials, as well as their composites. Metal material science is mainly a subject that studies the internal relationship between composition, structure, defects and properties of metal materials. The workers of metal material science and engineering should also study the relationship between the reaction process and phase of various metal smelting and alloy the preparation method and formation mechanism of metal material. According to its chemical composition Classification can be divided into iron and steel, non-ferrous metals and composite metal materials. Classification by use includes structural

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and functional materials. Metal matrix composite (MMC) has paid more and more attention because of its good properties. It is a kind of heterogeneous mixture based on metal or alloy and composed of metal or non-metallic wire, fiber, whisker or granule. It has a continuous metal matrix in common. At present, especially the materials used in the propulsion system of aerospace department, their properties have reached the limit. Therefore, a metal base composite with higher working temperature and greater specific stiffness and strength is developed. Material has become an important direction in the development of high-performance structural materials. In 1990, the United States formed a US $32.5 million market for advanced composites (mainly MMC) in space propulsion systems, with an average annual growth rate of 16%. It is much higher than the annual growth rate of high-performance alloys by 1.6%.

2. Structure and Properties of Organic Nan materials

Nan metallic materials based on resin, rubber, ceramics and metal matrix as continuous phase, nano-sized metal, semiconductor, rigid particles and other inorganic particles, fiber, carbon Nan tube and other modifiers as dispersion phase. Through the appropriate preparation method, the modifier uniformly dispersed in the matrix material to form a metal system with nanometer size material, which called nanometer metal material. The metal material is a bulk material, which is a mixture of nano-aluminum nitride and nano-aluminum.

The double nanometer metal material characterized in that the metal material is a bulk material and a mixture of nano aluminum nitride and nano aluminum. The invention has the following advantages: Al and AlN wetting each other without adverse interface reaction, and the AlN-Al phase interface is well combined; by changing the nit riding conditions, the nano-powder with different proportion of AlN and Al is formed in situ by plasma arc method. Because the binding form of Al and AlN is, mainly Al wrapped in AlN, Al is easy to form, the dispersed high melting point AlN improves the thermal stability of the material, and the bimetal metal material has good thermal stability.

Metal materials are widely used in aerospace, national defense, transportation, sports and other fields because of their excellent comprehensive properties, especially their design ability. Nano-metal materials are the most attractive part of them, and now they are developing rapidly. The development strategy of new materials in developed countries in the world puts the development of nonmetallic materials in an important position. This research direction mainly includes nano-polymer based metal materials, carbon Nan tube functional metal materials, nano-tungsten and copper metal materials.

In terms of chemical properties, it mainly manifested in ion resonance, thermal sensing, electromagnetic effect and catalysis, which decomposes small atoms with nanometer diameter through the diffusion of internal molecules at the level of ion resonance. Then through the fission of the nucleus, it eventually becomes an equivalent ion. After heating, each molecule has an equivalent calorific value through the transfer between the molecules in the nonmetallic material. The electromagnetic effect and catalysis mainly manifested in the electrical aspect. After passing through the current, it will stimulate the differentiation of the metal monomolecular electrode, and the original “will be transformed into”-”after the current alternating current, which will cause the magnetic field effect.

3. Preparation of bimetallic Nan particles

3.1 Template method

The standard for preparing metal materials by template method is the second processing based on original wet chemical synthesis. The first step is to invade nano- nonmetallic materials into hydrochloric acid solution or transparent colloid. In general, 27% sodium chloride or 45% sodium sulfate used in hydrochloric acid solution and iron hydroxide used as colloid. To dissolve the template attached to the macro porous metal, the chemical composition of which is Nacl,Al $(OH)_3$,

NaOH, and NaOH, Fe (OH) $_3$, accounting for 13%, 22%, 47%, 12%, as shown in Table 2, can be obtained by annealing.

Table 1 Distribution of chemical components

Ingredient	Nacl	$Al(OH)_3$	NaOH	$Fe(OH)_3$	Other
Proportion of possession	13%	22%	47%	12%	6%

3.2 Porous anodic aluminum oxide method

The principle of porous anodic aluminum oxide method has obtained by electrolysis of aluminum in sodium chloride solution. Aluminum is easy to oxidize to trivalent aluminum ion in air, and aluminum hydroxide does not react with sodium chloride. According to the reaction principle of strong acid and weak acid, no gas, precipitation and water formed in the reaction process, so this kind of reaction will not occur. The main control principle is to pour the resulting aluminum hydroxide into the hole and play a good sealing role. In this way, all the metal templates can make into porous metal during annealing. The metal material separated by electroplating to form the equivalent electromotive force, which is convenient for the metal material to separate the anions and cat ions into the equivalent electromotive force. It has become a nano-metal material with porous structure.

3.3 Colloidal particle seed method

Colloidal particle seed method is a preparation method based on nucleus growth theory. Firstly, colloidal particles synthesized by controlling conditions, and then colloidal particles were used as nucleation center and growth center to deposit the second kind of metal directly on the surface of colloidal particles, thus bimetallic Nan particles were prepared. Feng Zhong wei and others used gold Nan particles prepared by citric acid chemical reduction method as seed seeds. Under the condition of light, Ag has reduced to metal silver by sodium citrate and uniformly covered on the surface of gold particles. Spherical gold-silver composite Nan particles with good dispersion and regularity [1] were prepared Co-preparation of Au-Ag Composite Nan particles. The vibration scattering spectra and UV-vies absorption spectra are similar to those of Ag Nan particles. The resonance scattering light intensity of composite Nan particles is about 110 times higher than that of original seed particles. Philip et al synthesized 25 nm × 100 nm rod-like Au-Ag bimetallic Nan particles by chemical reduction deposition of silver on the surface of gold colloid particles rice particles [2]. Liu et al synthesized gold, core and silver shell Nan rods by depositing silver on the surface of gold Nan rods. With the increase of silver content, the Plasmon resonance absorption of Nan rods shifts blue, and the thickness of silver shell varies with the silver content in the reaction system. Au-Ag bimetallic Nan particles synthesized by seed growth with cationic surfactants as templates and Protestants by Bakshi et al. Zou et al synthesized novel Ag-Au bimetallic nanostructures with silver Nan particles as seed. It was found that these nanostructures depended on the molar ratio of gold to silver, and when the molar ratio of gold to silver increased from 0.5 to 4, Porous and dendrites' bimetallic nanostructures [4]. Pt-Au bimetallic Nan rods were prepared by adding H2PtCl6 into gold Nan rods containing CTAB and ascorbic acid. Pt-Au bimetallic Nan rods have two functions: one can used for surface-enhanced Raman spectroscopy; Catalytic return of O _ 2 to O _ 2 the original showed high activity [5]. Qian et al successfully synthesized Au-Pt Nan particles with core-shell structure on the surface of glass with gold Nan particles as seed and chorionic acid-ascorbic acid solution as growth solution. Au-Pt Nan particles and Pt electrodes have similar electrochemical properties. Using gold Nan rods as seed seeds, Au-Pt nanostructures with controllable structure have synthesized by seed growth method. The density and distribution of Pt on gold surface can accurately controlled by adjusting the experimental parameters. At low platinum ratio, platinum mainly appeared at the top and side edge of gold Nan rods. When the platinum ratio is high, platinum uniformly distributed throughout the gold Nan rods. Because platinum has grown along the epitaxial growth of gold Nan rods, the prepared platinum has a single crystal structure. Because of the unique surface Plasmon resonance of gold Nan rods, the

longitudinal surface Plasmon resonance absorption of Au@Pt nanostructures in visible and near infrared regions is obviously redshirt than that of gold Nan rods. The position and strength of absorption peak can adjust by the thickness of platinum shell in Au@Pt nanostructure. G Ao et al., using PVP as protective agent, reduced silver nitrate with hydrate to prepare silver sol, and then added H2PtCl6 into silver sol to synthesize hollow Ag-Pt bimetallic Nan particles. The position of plasmon resonance absorption on the surface of Ag-Pt bimetallic Nan particles can adjusted by the amount of H2PtCl6. Chen and other Ag@Pt Nan particles were synthesized by seed growth with presidium citrate as reluctant. By adjusting Ag-Pt ratio, Ag-Pt bimetallic Nan particles with different Pt layer thickness can obtain.

4. Summary

The optical properties, thermodynamic properties, dielectric properties, mechanical properties and catalytic properties of bimetallic nonmaterial related not only to the material itself, but also to the size and shape of particles. The future research focus of bimetallic Nan materials will be the development of materials with specific morphology and special functions. With the increasing improvement of synthesis methods, the types and preparation technologies of bimetallic Nan particles have shown a variety of rapid development. Bimetallic Nan particles with different particle size, different components and different structures can be easily prepared. Bimetallic Nan particles can reduce or reduced at the same time under the condition of containing the appropriate stabilizer. Two kinds of metal ions has prepared by continuous reduction. The structure of bimetallic Nan particles may be different when the synthesis methods are different. Compared with the size control of bimetallic Nan particles, shape control is more difficult. The change of environment may affect the growth of bimetallic Nan particles and regulate the nucleation of bimetallic Nan particles. The growth environment will help to solve the problem of bimetallic Nan particles size and morphology control. In addition, scientists need to make unremitting efforts and exploration on the application of bimetallic Nan particles in optics, electricity, catalysis and biology.

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