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center za prenos tehnologij in inovacij
na Institutu "Jožef Stefan"

Licensing opportunity

Molybdenum nanowires for the production of touchscreen materials and as starting materials for the preparation of lubricants and catalytic membranes

Field of use
Nanoengineering
Metals and Alloys
Nanomaterials
Inorganic Substances
Nanotechnology

Current state of technology
Stage of Development:
Available for demonstration

Patent status
patent granted

Publication
TBA

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Background

A Slovenian research institute has developed a procedure for synthesizing molybdenum nanowires. The procedure is efficient, low-cost and scalable. Molybdenum nanowires may be used in various applications, including lubricant, catalysis or touchscreen technology. The researchers are looking for industry and research partners for license or technical cooperation agreements.

Description of the Invention

Transition metals have a high technological utility value: molybdenum is used in applications accompanied by intense heating, such as the aircraft industry, electric contacts and industrial engines; it is also widely used in steel alloys to improve corrosion resistance. By developing nanomaterials, new properties are achieved and molybdenum nanostructures and its derivatives can be used in various applications, including lubricant, catalysis or touchscreen technology.

Slovenian researchers have developed a method for a synthesis of molybdenum nanowires, having a diameter below 1 micrometer. Such nanowires are prepared from molybdenum sulphide iodide and result in chemical composition as metals (molybdenum). Slovenian researchers can adjust the process in such a way, that carbides, nitrides or sulfides are the final product, which affects the properties of material.

The method for producing molybdenum nanowires is carried out in a reaction vessel (such as a quartz tube) which is aerated with a mixture of gases consisting of argon as carrier gas and hydrogen as a reducing agent. The conversion is carried out at temperatures above 700 °C.

Slovenian researchers have produced 100 mg of molybdenum nanowires in one batch using the presented method, but the procedure is scalable.

Application:

Reduced size and large length-to-diameter and surface-to-volume ratios make molybdenum nanostructures and its derivatives technologically applicable in various devices and applications (e. g. nanoelectronics, composites). Applications include, but are not limited to, metal lubricants, touchscreen materials and catalysts in membranes with selective permeability.

The researchers are among the leading scientists in their respective departments, and regularly publish in high-impact scientific journals; they have experience in working in small-scale laboratory settings. They

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are experts in the field of inorganic and analytical chemistry, synthesis of new inorganic materials with special properties, and nanotechnology.

Type of cooperation and partner sought:

Since the technology aims to reach its full potential in an industrial setting where such nanomaterials are needed, industrial or other research partners are sought. The technology is in the field of new materials, therefore technical cooperation is sought in order to facilitate continuous development rather than only routine production. Particularly welcome are partners in developing procedures for mass production of the starting material, molybdenum sulfide iodide.

Slovenian researchers are also interested in licencing patented method to industry or SMEs, which are looking for new nanomaterials to apply them to their products.

Main Advantages

Several different techniques and ways of synthesizing nanowires of transition metals are known, yet no method has been described for a synthesis of macroscopic (large) quantities of these structures by chemical conversion by heating in the presence of hydrogen.

Slovenian scientists have developed efficient, low-cost and scalable method to fabricate pure molybdenum nanowires. In the presented technology, molybdenum sulphide iodide in nanowire form are treated in a quartz tube aerated with argon followed by aeration with a mixture of argon and hydrogen. This is followed by heating above 700°C. Following a cooling step, the material is recovered and consists of molybdenum nanowires.

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MINISTRY OF EDUCATION, SCIENCE AND SPORT
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