

**GOVERNMENT OF INDIA  
MINISTRY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT OF SCIENCE AND TECHNOLOGY  
LOKSABHA  
UNSTARRED QUESTION NO.12  
TO BE ANSWERED ON 02.02.2022  
FUTURE ENERGY MATERIALS**

**12. SHRI VISHNU DATT SHARMA**

Will the Minister of **SCIENCE AND TECHNOLOGY** विज्ञान और प्रौद्योगिकी मंत्री be pleased to state:-

- (a) whether the Government is making efforts to promote research and innovation in future energy materials in general, and in aluminium ion batteries, sodium ion batteries, polymer batteries and graphene based batteries, in specific;
- (b) if so, the details thereof; and
- (c) if not, the reasons there for?

**ANSWER**

**MINISTER OF STATE (INDEPENDENT CHARGE) OF THE  
MINISTRY OF SCIENCE AND TECHNOLOGY AND EARTH SCIENCES  
(DR. JITENDRA SINGH)**

विज्ञान और प्रौद्योगिकी तथा पृथ्वी विज्ञान मंत्रालय के राज्य मंत्री (स्वतंत्र प्रभार)  
(डॉ. जितेंद्र सिंह)

(a) Yes, Sir.

(b) Department of Science & Technology (DST) is supporting development of indigenous technology for batteries, especially in the field of graphene-based batteries. DST has also supported a project on Graphene Protected Si Nano-Spheres (interconnected) for Developing High Energy Density Li-Ion Battery.

Science and Engineering Research Board (SERB) Statutory Body under the DST, has supported 42 projects including few national and international conferences/workshops in order to disseminate the knowledge of advancement in future energy materials in general, and in aluminium ion batteries, sodium ion batteries, polymer batteries and graphene based batteries in specific.

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) autonomous Research and Development Centre of DST, is working on materials and devices for super-capacitor and Na-ion (Sodium ion) battery as future technologies. ARCI has been engaged in

**development of indigenous technologies to produce electrode materials (cathode and anode) in large quantities for Li-ion batteries for electric vehicles. ARCI has also been successfully demonstrated technologies for Lithium-Ion-Phosphate (LFP) and Lithium Titanate (LTO), which are key materials in Li-ion batteries.**

**Indian Space Research Organization (ISRO) is working on indigenization of Graphite based materials and Lithium-ion cells for Space applications in view of high energy density and long life. R&D efforts on advanced materials based on cylindrical cells are in progress aiming to further improve energy density, cycle life and safety.**

**Department of Atomic Energy (DAE), Govt. Of India has fabricated Sodium ion coin cell with energy density of ~200Wh per kilogram using indigenously synthesized electrode material. In the field of lithium ion batteries, a cost effective, lab scale synthesis procedure for electrode materials has been established and the technology has been transferred to several companies. Several efficient cathode materials for next generation Li-S battery have also been developed. A polymer-based proton battery has also been designed and fabricated. Organic - inorganic hybrid perovskite material namely,  $\text{CH}_3\text{NH}_3\text{Pb}_{13}$  is a newly discovered solar cell material with photovoltaic efficiency more than 28%. A new kind of advanced energy material, namely, AgCuS, shows very good thermo-electric properties. DAE in collaboration with Jawaharlal Nehru centre for Advanced Science Research (JNCASR) has been working for the use of AgCuSin waste energy harvesting applications.**

**Central Electro Chemical Research Institute (CECRI), a constituent of Council of Scientific and Industrial Research (CSIR) has been engaged in Greener and cheaper iron based redox flow batteries for energy storage applications; Exploring graphene-based polymer nanocomposites for supercapacitor applications; Enabling the development of Na-ion batteries Scaled-up synthesis of high power Li-ion battery materials-indigenous technology development; Electrospun nanofibers as functional materials for Lithium-Sulfur batteries; and Development of new Mg-S battery chemistry and electrodes through synthesis characterization and simulations.**

**NITI Aayog has nudged institutions to focus on creating world-class EV R&D infrastructure and innovation programs to create future workforce and facilitate the acceleration in adoption of Electric Mobility ecosystem in India. So far 9 IITs have launched higher educational programmes at master's and doctoral levels and some have established dedicated centres.**

**(c) Not Applicable.**

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