Paper ID: 67594
student

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Interactive Presentations - IAF MATERIALS AND STRUCTURES SYMPOSIUM (IP)

Author: Mr. Paul Kiesling
BLUECUBE Aerospace, United States, pkiesling@bluecubesat.com

Mr. Kevin Simmons
BLUECUBE Aerospace, United States, ksimmons@bluecubesat.com

VIABILITY AND ADVANTAGES OF GRAPHENE PRODUCTION IN DEEP SPACE ENVIRONMENT

Abstract

As the world continues to advance in space exploration, resources must be prioritized towards the research of novel solutions that utilize deep space and its conditions to solve problems and advance technologies on Earth. As coined by NASA in its 2014 definition of Planetary Sustainability, the future of our world depends on a multi-planetary society where people of Earth can access the resources of the Solar System. This stands in accordance with NASA's mission "To drive advances in science, technology, and exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of the Earth." One of the key issues that the mankind is currently facing is environmental sustainability which roots from the lack of clean renewable energy. Scientists can help address this issue through research and development of graphene-based solar power which can be further evolved in deep space environment.

Graphene, a 2D allotrope of carbon, is a single layer of graphite with carbon atoms arranged in a hexagonal, honeycomb lattice. Graphene is the thinnest, lightest and strongest material currently known to science and it has the highest thermal and electric conductivity. Often referred to as a wonder material due to its wide range of applications, scientists believe that graphene can be used in manufacturing of vehicles, bullet proof vests, spacesuits, spacecraft and space elevator. However, with its highly optical transparence, electrical conduction and mechanical flexibility, one of the most revolutionary applications of graphene could be its integration in solar panels. Studies show that graphene can collect hundred times more solar energy than a regular photovoltaic cell. This increased energy production can be achieved because graphene can be utilized as an electrode charge carrier, transporting electrons in the form of electric current. Graphene is extremely efficient in performing this task, significantly increasing solar panel efficiency. In addition, graphene can be used to replace the expensive indium tin oxide coated glass, commonly used as the electrode charge carrier for transparent solar cells.

Despite its known advantages, it is difficult to grow large strands of pure graphene on Earth because convection flows distort its atomic structure. This paper will examine the methods, viability and advantages of growing larger pieces of graphene in microgravity due to the loss of convection. Continuous research in this field can help the world meet its increasing energy needs, and deliver significant value to the aerospace sector, propelling humanity into a new era of space exploration.