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NOVEL ELECTROSPUN CERAMIC NANOFIBER FILTRATION SYSTEM FOR CAPTURING LUNAR DUST

Abstract

Since the first steps of a human being on the lunar surface were made, lunar dust has arisen as a major issue. It is speculated that it may cause malfunction of mechanical equipment, respiratory problems, and infectious diseases. Even worst, lunar dust may cause air loss through damage and blockage of seals on gates (spacecraft, space suits, etc.). Therefore, air purification in Martian and lunar missions are a top priority. Otherwise sustainable habitation in extraterrestrial space might not be possible. The common method to remove dust from air is filtration. Recently, instead of conventional microfiber filtration systems, filtration media composed of nanofibers have drawn attention thanks to highly improved filtration quality. In this presentation, the fabrication and testing of a novel air purification system based on nanofibermats will be introduced. The design consists of ceramic nanofibers, e.g. TiO2, that are deposited as nanofibermats on top of a micron size support. Ceramic fibers have the definite advantage over polymer fibers in durability which is critical especially in case of limited resources. These filters also bear the advantage that they can be regenerated by microwave energy. Any molecules or organisms that could be harmful would be destroyed and turned into volatile species like CO2, water or minerals. The filter is fabricated via electrospinning of ceramic precursor prepared based on sol-gel chemistry, followed by the heat treatment process. The formation of the ceramic nanofiber depends on a high electric field between the spinning needle and the fiber support. Electric fields of 2 to 3 kV/cm typically yield fibers with diameters around 100 nanometers that are randomly deposited and form a fiber mat. We will report results on fabrication, characterization of the ceramic nanofibers and their effectiveness in aerosol penetration testing.