kohlenstoff-faserverstärkten Kunststoffen unter Trockenbearbeitung im Vakuum an (radiale Schnitttiefe: 12 mm, axiale Schnitttiefe: 5 mm).

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Smart Materials in Space Instrumentation

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Smart materials have been around for many years and they have found a large number of applications. The use of the terms 'smart' and 'intelligent' to describe materials and systems came from the US and started in the 1980's despite the fact that some of these so-called smart materials had been around for decades. Many of the smart materials were developed by government agencies working on military and aerospace projects [1].

A smart material is one which reacts to its environment all by itself. The change is inherent to the material and not a result of some electronics. The reaction may exhibit itself as a change in volume, a change in colour or a change in viscosity and this may occur in response to a change in temperature, stress, electrical current, or magnetic field. In many cases this reaction is reversible, a common example being the coating on spectacles which reacts to the level of UV light, turning your ordinary glasses into sunglasses when you go outside and back again when you return inside.

There are many groups of smart materials, each exhibiting particular properties which can be harnessed in a variety of high-tech and everyday applications. These include shape memory alloys.

Nowadays, much research is devoted to the SMP/SMPC applications in aerospace. However, space environment is extremely harsh, and many important factors must be considered when selecting structure materials in space environment, such as high vacuum, ultra-high or low temperature cycle effect, ultraviolet (UV) radiation, and so on; they can decrease the work effectiveness of solar arrays and increase the challenge component to normal work.

Solar arrays are the main energy generation subsystems in space-deployable structures to obtain energy in space and are commonly packaged in the vehicle before launch; once in-orbit, the solar array is released to deploy and collect energy, and its work efficiency is dependent on a large deployment area, reliable stiffness and lightness of weight. Today, solar array structures have different forms, such as rigid, semi-rigid and flexible types [2].

The antenna is the important communication tool between the satellite and Earth in space, which can provide necessary information about space matter. Two main parameters measure the deployable antenna working properties: the reflector aperture and precision. However, the two parameters are contradictory in certain ways—the structure would be very complex if the two parameters could be satisfied simultaneously. In addition, the weight and packaged volume of the deployable antenna are also considered in the design.

Researchers have proposed several types of structure models, such as the wrap-rib deployable antenna, the rigid-rib deployable antenna, the hinged-rib deployable antenna and the tension truss antenna. All the aforementioned antennas have some drawbacks concerning the weight, reflector aperture or surface precision. As one of the ideal advanced materials, SMPCs can overcome these drawbacks and play an increasingly important role in space deployable antennas.

Harris Company has been considering using the concept of SMPCs to design a new type of smart solid-surface deployable reflector called the Flexible Precision Reflector (FPR) and has created some models for deployment experiment, as shown in figure 1. The structure consists of two parts: the outer stiffener fabricated using an EMC material and a thin film surface reflector in the middle part. The structure is packaged in stowed configuration, which can be actuated to deploy in some manner, such as by using light or temperature change [3].

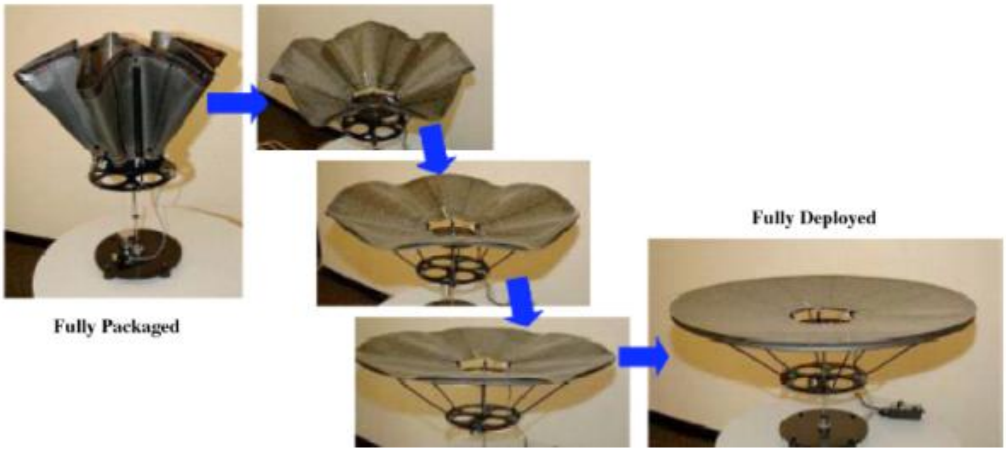

Figure 1 - The deployment stages of Breadboard deployment

Recently, NASA has been developing a new type of radar antenna under the Earth Science Technology Program, which has a large deployable aperture and good emergency response ability; its shape is the Sunflower model, as shown in figure 2. After many fabrication, examinations and evaluations, the results demonstrate that the key factors of the production program rely on the application of SMPs and SMPCs in the design of rigidizable-inflatable (RI) structures at reasonable cost. The SMPC antenna not only satisfies the complex structure demand but is also lightweight and exhibits high reflector precision [4].

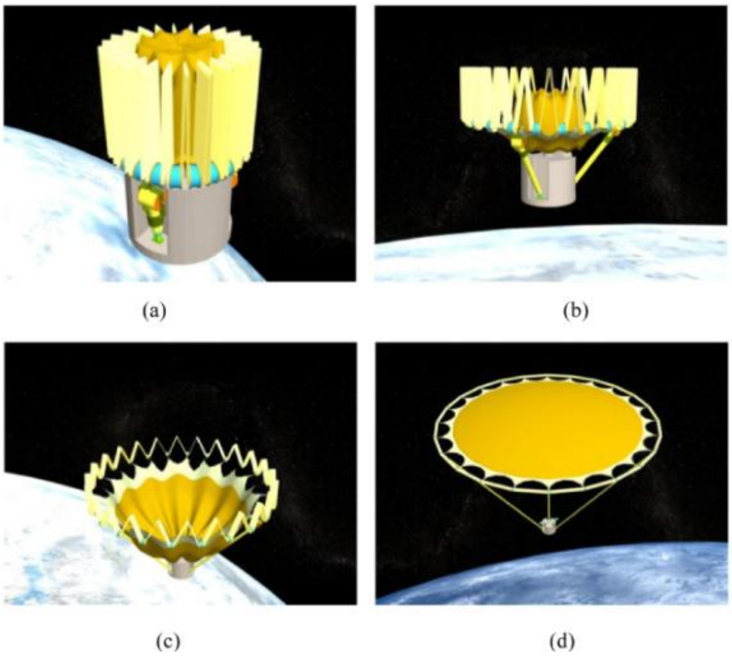

Figure 2 - The deployment process of Sunflower reflector model: (a) the stowed state, (b) and (c) partial deployed state and (d) fully deployed state.

As one kind of advanced smart material, SMPs and SMPCs are playing an increasingly important role in the aerospace field. Remarkable research works are focusing on the design and evaluation of SMPC components, such as SMPC hinge and boom. Different types of components have been developed to better meet the need of space deployable structures, such as solar arrays and deployable panels, reflector antennas.

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Colonization of the Moon. Myth or Reality?

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1. Introduction

“That’s one small step for (a) man, one giant leap for mankind.” – Famous words said when Armstrong first stepped onto the moon (20 July 1969). Interestingly enough, no human being has stepped foot on the Moon since 1972. It has been 39 years since we’ve last treaded the mysterious dusty surface – but to this day groundbreaking discoveries are made year after year [1].

The colonization of the Moon is the proposed establishment of permanent human communities on the Moon. This paper evaluates the extent feasible the idea of colonization the moon and its economic feasibility [2].

The notion of setting a colony on the Moon originated before the Space Age. In 1638 Bishop John Wilkins wrote A Discourse Concerning a New World and Another Planet, in which he predicted a human colony on the Moon. Konstantin Tsiolkovsky, among others, also suggested such a step. From the 1950s onwards, a number of concepts and designs have been suggested by scientists, engineers and others [3].

2. Myth or reality?

Permanent human habitation on a planetary body other than the Earth is one of science fiction's most prevalent themes [4]. As technology has advanced, and concerns about the future of humanity on Earth have increased, the argument that space colonization is an achievable and worthwhile goal has gained momentum. Because of its proximity to Earth, the Moon has been seen as the most obvious natural expansion after Earth.

3. Advantages and disadvantages

Putting aside the general questions of whether a human colony beyond the Earth is feasible or scientifically desirable in light of cost-efficiency, proponents of space colonization point out that the Moon offers both advantages and disadvantages as a site for such a colony [2]. Naturally there are pro’s and con’s to colonization.