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DEVELOPMENT OF A METALLISED CARBON FIBER REINFORCED PLASTIC (CFRP) ANTENNA REFLECTOR FOR SATELLITE COMMUNICATION

A C Mathur, Dr. B S Munjal Somasekhara
Space Applications Centre (SAC), ISRO, Ahmedabad-380015
e-mail- acmathur@sac.isro.gov.in, phone 079-26912106, 26912129, Fax 26912110

Mohan Kumar , L Srikanth, Rahul Kumar, D Venkatsubramaniam, Dr. R M V G K Rao,
National Aerospace Lab (NAL), Bangalore

The Antenna reflectors made of Carbon Fibre Reinforced Plastics (CFRP) are used in spacecrafts for Satellite Communication in C, S and Ku bands. For futuristic Satellite Communication applications in 'Ka' band, there is a need of improving the reflectivity for Radio Frequency (RF) signals by metallising the surface of CFRP reflectors. The space qualified CFRP reflectors have been developed by ISRO for various GEOSAT projects but the process for developing a space qualified reflector having a metallized surface has not been established in the country. Recently, efforts in this hitherto unexplored domain have been made jointly by Space Application Center, Ahmedabad and National Aerospace Lab, Bangalore to develop reflectors with metallized surface.

In the proposed paper, the various processes finalized after synergistic interactions of SAC and NAL engineers, which can be used for metallising the convex surfaces of the antenna reflectors made up of CFRP would be discussed.

The various methods are being tried by SAC to metallise CFRP parts. The following three processes are being tried at NAL.

- (a) Embedding of Copper cladded Kapton sheet
- (b) Embedding of a metallized (Silver impregnated) fabric
- (c) Deposition of Aluminium by Vacuum Deposition Process (VDP)

The first process i.e., Embedding of Copper cladded Kapton sheet was tried first on a 300mm dia reflector as the 75 micron thick Copper cladded Kapton sheet was readily available at SAC, Ahmedabad. Teething problems were faced in embedding the sheet because of reflector curved skin, wrinkling and overlapping of Kapton sheet.

The other two processes i.e., (1) Embedding of a metallized (Silver impregnated) fabric (2) Deposition of Aluminium by Vacuum Deposition Process (VDP) have been tried by NAL, in developing 300 mm dia & 800 mm diameter reflectors. Flat test coupons of size 100x50mm have been supplied by NAL for carrying out various environmental, physical and RF tests etc. needed for space qualification, by Quality Assurance group of SAC.

The merits and demerits of each process, would be discussed in addition to the results of various environmental and electrical (RF) tests conducted to qualify the processes as per the guide lines laid in ASTM 595 and ASTM 1559 and ISRO Test documents for the products used in the Space environment.

At the end of the paper, the status of development of these state-of-the-art reflectors, would be presented along with the process to be adopted in the future. This is an indigenous development for a world class component and is an import substitute item for futuristic ISRO's GEOSAT programme.



Fig. 1 800mm dia. CFRP reflector



Fig. 2 300mm dia metallized reflectors