PROTECTIVE COATINGS FOR TUBULAR BOOMS APPLICATIONS

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ABSTRACT

The tubular boom is a generic technology of deployable structures for space applications, which may be adapted to fit many missions and instruments. Advantage of such technology is small volume and mass of such mechanisms due using tensioned tapes, not standard tubes. In stowed configuration of the boom, the tape is stored on reel, during deployment it is unwound from storage reel and change shape into tubular boom, depend on material type and dimensions of tape such boom can reach up to even 5 meters length.

The application of such technology often depends on boom material: stainless steel is usually used for manipulators, CFRP composites for large structural booms, while copper alloys seem perfect for miniature booms and antennas. All of these tubular boom applications need to fulfil almost identical conditions in order to ensure correct and reliable operation. Astronika company has great experience with tubular boom technology and is manufacturer of both: mechanism and booms which were already used in several flight missions, presented results are part of development of new material solution for this products.

The main objective of this research was to propose, develop and test the surface modifications: coating and mechanical surface finish of thin - 0.08mm of thickness - metallic copper beryllium tapes used for tubular boom applications in space instruments and mechanisms. The need to develop these surface modifications is associated with preventing the cold-welding effect, improving wear resistance, decreasing the friction coefficient, and achieving the proper thermo-optical parameters and electrical conductivity of ready-made tubular booms.

To achieve these effects, three thin (below 1 micron) DLC composite coatings: Cr/W-C:H, Cr/CrN+CrCN/Cr-C:H, Cr/CrN+Ag/Cr-C:H were produced by PVD method on CuBe2 tapes. Such materials were characterised using SEM observation and EDS chemical composition measurements and tested using scratch test, nanoindentation and cold welding test. Furthermore, additional mechanical surface treatment of CuBe2 tapes were performed: polishing and grinding and thermo-optical properties of modified CuBe2 tapes were performed in comparison to substrate material and CuBe2 tapes coated with DLC coatings.