MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Poster Session (P)

Author: Mr. Ralf Purschke
Technische Universität München, Germany

EVALUATION AND TEST OF POLYAMIDE GEARS FOR POINTING MECHANISMS

Abstract

Requirements on pointing mechanisms are getting harder continuously. Telescopes have to be turned exactly, cameras must move very accurate, and antennas have to be pointed precisely. With the raising demand for more data downlink, for example, the transmission frequency has to decrease and thus the main lobe of the antenna is getting smaller and consequently the pointing of the antenna has to become very accurate. For a Ka-band antenna, the pointing accuracy has to be in the range of 0.1deg. To fulfill the raising demands, pointing mechanisms have to be designed lighter, more efficient, and more reliable. Therefore, the components of space mechanisms have to be improved continuously and new design ideas have to be evaluated and tested. This work studies the possibility to use gears made of polyamide in pointing mechanisms.

Therefore, (1) state of the art gear solutions and polyimides were studied, (2) a test setup was developed to test the behavior of the gears in a space environment, and (3) the tests with polyamide gears were conducted and evaluated.

Polyamide gears have the advantage of low weight, not requiring lubrication, good vibration behavior, and no corrosion. This makes them an interesting alternative to traditional metallic gears. The most promising materials for synthetic gears are, among others, Peek and Vespel. Both have excellent characteristics in outgassing, wear, strength, and thermal behavior. To test the Peek and Vespel gears regarding their performance in space environment, a test setup was designed. With the test setup one of the most important characteristics of gears can be measured: backlash. Backlash can be measured depending on lifetime of the gears and environment. Furthermore strength and wear of the gears can be determined with other test setups.

First results do not show an increase of backlash of Peek and Vespel gears when put in thermal-vacuum environment. The wear after one million revolutions is negligible and strength is absolutely sufficient for pointing applications. Although more tests are planned in future, the first tests show very promising results regarding the application of polyamide gears in pointing mechanisms.