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DEVELOPMENT OF A NOVEL WIRE-WOVEN TIRE FOR EXPLORATION ROVER USING
SUPERELASTIC SHAPE MEMORY ALLOY WIRES**Abstract**

The Mars exploration rover can carry out many important scientific missions such as searching for and characterizing a wide range of rocks and soils for clues to past water activity on Mars. To ensure safe operation and extend the life of the Mars exploration rover, the wheels are required to be light-weight, durable and can conform to the terrain. Only in this way, can the wheels hold the weight of the rover and drive over complex terrain. Since the Mars surface has many pointed rocks and gravel, the tires need to be wear-resisting and undergo large deformation. Currently, most wheels of Mars exploration rover are aluminum wheels and they are usually damaged by the pointed rocks and gravel on Mars, which prevents the Mars exploration rover from continuing to conduct scientific tasks. Consequently, a novel superelastic NiTi shape memory alloy (SMA) wire-woven tire is proposed, which is light-weight, durable, and conforming to the terrain. To satisfy the requirements of Mars exploration rover navigating on the Mars, NiTi SMA and wire-woven technology are employed. The superelastic SMA straight wires are constrained on a mold and set as a coil shape through special heat treatment. Then these coils are woven to form a SMA wire-woven tire. To verify the excellent wear-resisting and large deformation properties of SMA wire-woven tire, a prototype of it and a contrasted steel wire-woven tire are fabricated and tested. According to the results of the tests, SMA wire-woven tire shows great advantages in light-weight and large deformation performance than the traditional aluminum wheels. Moreover, compared to the steel wire-woven tire, SMA wire-woven tire shows better wear-resisting and large deformation performance. Experiments show that the SMA wire-woven tire can conform to the terrain better, which gives it potential for exploration rover applications.