**Abstract:** Shape Memory Alloys have the ability to produce very high actuation strain (up to 20%), stress (~400 MPa) and work output (~10 MJ/m³) as a result of reversible martensitic phase transformations. However, they are limited to use at temperatures below 100°C and stress levels below 600 MPa. NiTiHf alloys with relatively low cost and moderate ductility, appears to be the most promising HTSMA for use up to temperatures of ~200°C in aerospace applications (e.g. variable geometry inlets and nozzles). However, their low strength results in poor and unstable shape memory response.

In this study, Ni-rich NiTiHf alloys are thermally treated and chemically alloyed (Cu, Pd addition) to demonstrate stable cyclic shape memory behavior. Aging results in formation of nanometer-size precipitates, and thus increased strength and stable shape memory behavior. Moreover, formation of precipitates increases the transformation temperatures by altering the composition of the matrix. It has been concluded that aging is an effective tool to tailor shape memory and mechanical properties of Ni-rich NiTiHf-based alloys and NiTiHf based alloys can be utilized for high temperature and high strength shape memory applications.

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