Department seminar

Tuesday January 31, 2023, 13.30 meeting room 117

Laser Powder Bed Fusion of NiTiHf High Temperature Shape Memory Alloy: Formability, Thermal Stability, and Shape Memory Effect

Hongwei Ma

Among the potential high temperature shape memory alloys (HTSMAs), NiTiHf alloys have been regarded as the most promising HTSMAs for a wide range of applications in the 100-300 ºC , owing to their high transformation temperature (>100 °C), considerable thermo-mechanical stability, outstanding work output and lower cost compared with NiTi-X (X=Zr, Au, Pt, Pd). Therefore, the NiTiHf HTSMAs potentially impact the automotive, aerospace, and energy exploration industries by simplifying and improving the operating efficiency of mechanical components designed to operate beyond 100 °C.

However, it should be noted that the processing and machining of NiTi-based (NiTi, NiTiCu, NiTiHf, etc.) SMAs is challenging due to their low thermal conductivity, high reactivity, spring back effects, and burr formation and adhesion. Therefore, components made from NiTi-based SMAs are typically simple in terms of their geometric complexity. Laser powder bed fusion (L-PBF) as a layer-by-layer additive manufacturing process can fabricate highly complex structures such as thin-walled structures and lattice-like shapes without the need for post-machining processes. Undoubtedly, L-PBF applied to fabricate NiTi-based SMAs components directly can expand the range of their applications.

In this presentation, formability, thermal stability, and shape memory effect of L-PBF NiTiHf HTSMAs will be covered, and the effects of processing parameters on these properties will be studied systematically.