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The effect of Hf on the microstructure, transformation behaviors and the mechanical properties of Ti-Ni-Cu shape memory alloys

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Abstract

The effect of substitution of Hf for Ti and Cu for Ni on microstructure, martensitic transformation behavior, mechanical properties and strain recovery characteristic of quaternary Ti-Ni-Cu-Hf alloys were investigated systematically. The results reveal that the B19→B19′ martensite transformation can be controlled by tailoring the Hf contents in Ti-Ni-Cu alloys. Although the B19 and B19′ martensite coexisted in Ti-Ni-Cu alloys with the minor Hf addition, only one-stage B2→B19′ transformation was observed in heating and cooling process. The transformation temperatures and transformation hysteresis can be adjusted by optimizing the chemical composition. In addition, the superior mechanical properties and shape memory effect can be achieved by tailoring the Hf can Cu contents. The maximum shape memory effect strain of 3.06% could be obtained in $Ti_{47}Ni_{44}Cu_6Hf_3$ alloy. And $Ti_{45}Ni_{44}Cu_6Hf_5$ alloy showed the largest tensile strength of 770 MPa. The present study provided the theoretical foundation for the potential application of the