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Ti substituted Ni-free $Zr_{65-x}Ti_xCu_{17.5}Fe_{10}Al_{7.5}$ bulk metallic glasses with significantly enhanced glass-forming ability and mechanical properties

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Abstract: We report the significant effect of Ti substitution on GFA and mechanical properties of Ni-free Zr-based BMGs. A series of $Zr_{65-x}Ti_xCu_{17.5}Fe_{10}Al_{7.5}$ ($x = 0, 2, 4, 6, 8$) bulk alloys were fabricated by the injection copper-mold casting method, and new $Zr_{65-x}Ti_xCu_{17.5}Fe_{10}Al_{7.5}$ BMGs with Ti content of 2-6 at.% were developed. Both the GFA and mechanical properties of the $Zr_{65-x}Ti_xCu_{17.5}Fe_{10}Al_{7.5}$ alloys are significantly enhanced with the increase of Ti content up to 4 at.%. The as-prepared quinary $Zr_{61}Ti_4Cu_{17.5}Fe_{10}Al_{7.5}$ BMG shows the largest supercooled liquid region width of 86 K, compressive fracture strength of 1915 MPa and compressive plasticity of 11.4%, which are much higher than 38 K, 1745 MPa and 3.0% of the pristine $Zr_{65}Cu_{17.5}Fe_{10}Al_{7.5}$ BMG.

Key words: Zr-based alloys; bulk metallic glass; Ti substitution; glass-forming ability; mechanical property; Ni-free

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