Development of Novel Lightweight Ti-Rich Medium Entropy Alloys

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Lightweight titanium-rich medium-entropy alloys (MEAs) have great potential in the aerospace and automotive industries due to their low density and excellent material properties. In order to reach the light weight purpose with density comparable to commercial Ti alloys (~ 5 g/cm3), therefore, only limited elements were selected. Accordingly, a nonequiatomic quaternary alloy system, Tix(AlCrNb)100-x (x = 45–80), was firstly designed through the calculation of phase diagrams (CALPHAD). All of these as-cast alloys exhibited a single BCC structure with high yield strength and high plasticity (more than 30% plastic strain) at room temperature. Moreover, the Ti65 alloy demonstrated tensile elongation of up to 32% plastic strain and ultimate tensile strength of 1200 MPa after homogenization treatment for 24 h. Based on the solid solution strengthening concept, this quaternary Ti65 base alloy was modified by adding V and Zr elements to extend into quinary and hexamerous alloys. Then follow a series thermomechanical treatment, the final Ti-rich MEAs can obtain a hetero-structure and reach a superior synergy of mechanical properties and ductility, 1350MPa yielding strength and 15% elongation, the specific yielding strength can reach up to 270 MPa·g/cm3.

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Experience:

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