Development of new high-temperature materials, incorporating alloys based on metals with higher operating temperatures and melting points along with optimum properties, has always been motivated for their applications, typically in aerospace and marine industries. High-Entropy alloys (HEAs), or multicomponent alloys with equiatomic or close-to-equiatomic compositions, based on group IV, V and VI refractory elements, can be potential candidates due to their attractive high-temperature properties. However, inadequate ductility puts a limit on their mechanical performance for structural applications. A strategy is proposed here to design refractory HEAs with yield strength reaching 1000 MPa, and importantly with sufficient ductility at room temperature. Ductility is introduced by maintaining the number of total valence electrons low, and this is controlled by adjusting the alloy compositions. In addition, thermomechanical treatment is also utilized to further fine tune the mechanical properties via modifying the microstructure. Our findings will shed light on the design of refractory HEAs with optimal mechanical properties.