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Effect of Nb addition on microstructure and corrosion behavior of Ti-V-Cr-Nb High Entropy Alloys

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High entropy alloys (HEA) have received great attention and have been extensively studied due to their outstanding properties, such as high thermal stability, high wear, oxidation and corrosion resistances, as well as the possibility of tuning their properties by adjusting the composition properly. HEA systems presenting solid solutions with BCC structure usually present high hardness and wear resistance. Furthermore, the development of a single-phase solid solution is a typical strategy in the design of corrosion resistant alloys, and the high entropy of these alloys contributes to achieving this goal. This present work aims to study the effects of Nb content on microstructure and corrosion behavior of Ti-V-Cr-Nb high-entropy alloy system. The addition of Nb contributes to the stabilization of the BCC solid solution but there is a lack of information on its effect on the corrosion properties of the alloys. Corrosion tests were performed in a 3.5 wt.% sodium chloride solution. The corrosion resistance was assessed by potentiodynamic polarization measurement and electrochemical impedance spectroscopy techniques. The microstructures were analyzed by scanning electron microscopy, energy-dispersive X-ray spectroscopy, and X-ray diffraction. The results showed that the alloys obtained by arc melting in the Ti(30-x)VCrNbx (x= 0, 5, 10, 15, and 20) compositions are single-phase, consisting of a solid solution with a BCC structure. Among alloys, Ti10V35Cr35Nb20 showed the highest corrosion potential, the lowest corrosion current density and corrosion rate. Thus, this study suggests that the proper addition of Nb significantly influences the final performance of the alloy.