Effect of minor B additions on the microstructure of AlCoCrFeNi high entropy alloys

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Traditional metallic materials are generally constituted up to two principal elements with minor alloying addition of various metallic and non-metallic elements. Recently the so called high entropy alloys (HEA) were discovered. As a general rule, these alloys are constituted by five or more elements with atomic percentage varying from 5 to 35%. Despite the great number of different “principal-elements”, in many cases, formation of a single cubic solid solution is observed. These solid solutions are formed by many different atoms within the structure and it results in great distortion of the lattice. As a consequence, these alloys present excellent mechanical properties such as high hardness and high yield strength. In the present work, the effect of minor additions of boron on the microstructure of AlCoCrFeNi high entropy alloys was analysed. Alloys of atomic composition AlxCoCrFeNiBy, with x = 0.75 and 1, y = 0, 0.05 and 0.1 were studied. The samples were fabricated by arc-furnace and were also submitted to a homogenising heat treatment in order to study the equilibrium microstructure of the different alloy compositions. Microstructural characterization was performed by X ray diffraction (XRD), optical microscopy (OM), scanning and electron microscopy (SEM and TEM). Addition of boron on the HEA alloys lead to the formation of Cr,Fe-rich borides and also changed drastically the proportion of BCC/FCC solid solutions. The heat treatment changed the borides morphology as well as the proportion of FCC/BCC phases.