Studying of Fine Structure of Coatings and Deformed High Entropy Alloys With the Using of Analytical Electron Microscopy

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The recently developed high-entropy alloys (HEAs) are the new class of alloys which typically consist of at least five principal elements with atomic concentration between 5% and 35%. The HEAs demonstrate high properties [1-3] and show great potential for aircraft and engineering applications due to their promising properties in hardness, wear resistance, corrosion resistance, and high-temperature stability.

The method of analytical transmission electron microscopy was used for studying of fine structure of coatings and high deformed HEAs [4]. High locality of quantitative x-ray microanalyses is achieved by studying of thin foils (thickness about 100 nm) and fine electron beam (0,5-1,5 nm).

Chemical composition of HEAs in the initial state varies in the range of 10 percent at a distance of a few nanometers. After ECAP alloy becomes more homogeneous (the deviation is 1-2 at.%). Hardness increased to 5,1 GPa, with a slight increasing the elasticity modulus up to 78 GPa.

The phase and chemical compositions do not undergo significant changes during magnetron sputtering. But the application of a negative bias voltage to the substrate allows to form the homogeneous structure instead of a columnar one, which leads to increasing the hardness from 14 to 17.5 GPa of the AlCrFeCoNiCuV coatings.

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