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Effect of Growth Temperature on the Structure of CoCrFeNiCu High Entropy Alloy Films

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The five component CoCrFeNiCu films were deposited by DC magnetron sputtering using spark-melted targets at background pressure of 5×10−6 Pa with a deposition rate of ˜10nm/min. The working pressure was 0.3 Pa by applying 99.9 % pure argon as sputtering gas. The films were deposited onto oxidized (100) Si wafers. The growth was carried out at room temperature as well as at 380 oC.
The nanostructure of the films was analyzed by traditional transmission electron microscopy (TEM) in a Philips CM20 microscope at 200 kV accelerating voltage. High resolution TEM measurements were made in a Cs corrected 200 kV JEOL ARM 200cF microscope with atomic resolution. Samples for TEM investigation were produced in cross section views by Ar+ ion milling at grazing incidence.
The structure of the films grown at room temperature is single phase FCC and corresponds to zone T structure, with a well expressed <111> texture. The width of the columns is rather uniform, about ˜25 nm, and the growth competition region is about 50 nm thick in the 500 nm thick film. The columns are rather defective, the main defects being planar defects.
The film grown at high temperature possesses also the single phase FCC structure, the morphology is at transition from zone II to zone III. This is also supported by the random crystallographic orientation of the grains.
A detailed electron microscopic investigation and the possible formation mechanisms of the observed structures will be discussed.

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