NANOSTRUCTURED A-FE LAYERS SYNTHESIZED IN LOW-PRESSURE MICROWAVE PLASMA

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Abstract
We have used microwave plasma at the low pressure of 2 kPa to synthesize nanostructured α-Fe layer. This layer was deposited on a glass substrate which was immersed in Ar plasma (microwave power of 250 W). Iron pentacarbonyl Fe(CO)5 was flown over the substrate and its decomposition resulted in the formation of a few micrometers thick fully nanostructured iron layer. The deposition time was 60 seconds. The synthesized samples were studied using XRD, SEM, EDAX and 57Fe Mössbauer spectrometry. Only α-Fe phase with the mean crystallite size of 14 nm was observed in the XRD pattern of the representative sample. It was observed in SEM that the fine structure of the layer exhibited a kind of columnar structure whereby the columns were formed of nanocrystals. No voids were observed and oxygen, due to its low concentration, was hardly detectable with EDAX. In the transmission Mössbauer spectrum, as well as in the conversion-electron Mössbauer spectrum, collected on the pieces of the layer, α-Fe sextet dominated and a surprisingly low amount of iron oxides was identified (respective spectrum area was about 1 %). It means that the pieces of α-Fe layer were very weakly oxidized.

Keywords: nanomaterial, plasma synthesis, iron layer

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