

Investigations on high temperature behaviour of Mn/Si combinatorial libraries in defined atmospheres on Fe substrate

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The major advantage of investigations on combinatorial libraries is the possibility to simultaneously generate a multitude of different compositions within one single production process on one sample. Thus, the influence of the composition on the oxidation behaviour for instance can be easily evaluated without the necessity of handling several samples.

Combinatorial manganese/silicon thin films on iron substrate (99.6 at.-% purity) were deposited using a self-made state of the art vacuum chamber in order to investigate their properties. The concentration of manganese was set from 30 to 70 at.-%, and the amount of silicon from 70 to 30 at.-%, along the 76 mm y-axis of the sample. Subsequently, they were annealed at atmospheric pressure at 900 °C, for annealing times of 120 s and 600 s in atmospheres containing 10 % H₂ in N₂ at defined dew points. The oxygen partial pressure was chosen to be only oxidative for the elements in the combinatorial library, but not for the Fe substrate material.

On the one hand the surface structure of the annealed samples strongly depends on the composition of the deposited thin film. On the Mn-rich side of the substrate the sample shows a regularly arrayed surface, whereas the Si-rich side provides rather disordered amorphous surface structures. On the other hand the oxygen partial pressure represented by the dew point during annealing must be taken into account, as it represents the oxidative force according to Ellingham diagrams. With increasing dew point more oxide structures could be found at the surface.