SURFACE MORPHOLOGY OF $Fe_{78}Si_9B_{13}$ RIBBONS

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Abstract

Amorphous metallic glasses (AMG) are most commonly prepared in a form of ribbon by rapid solidification of the melt on a rotating wheel. One of the parameters of the production process, which can affect the structure and surface quality of AMG, is the wheel speed. The aim of this work is to find out how the surface morphology of $Fe_{78}Si_9B_{13}$ changes according to the peripheral wheel speed. We have used the modern technique of surface analysis–the Atomic Force Microscopy (AFM).

Dependence of thickness (d) of the prepared $Fe_{78}Si_9B_{13}$ ribbon on the peripheral wheel speed (v) is presented in Fig. 1. The graph shows that with increasing peripheral wheel speed the thickness of the ribbon decreases. This decline is well described by a power function with exponent (the slope of the line) of -0.97± 0.02 which is consistent with the theoretical dependence according to which $d = 1/v$. The value of exponent close to -1 was experimentally confirmed by a number of researchers.

The glossy surface of a ribbon prepared with speed of 40 m/s has a specific mesh pattern composed of irregular holes the edges of which are interconnected. The structure with RMS roughness of only 0.4 nm is assumed to represent the basis for the formation of new crystals during annealing the alloy.

On the glossy surface of the ribbon prepared with speed of 15 m/s a channel was formed due to unstable condition of casting. This channel divides the surface of the alloy into two regions with different morphology. Inside the channel, the protrusions have an average height of 12 nm and a shape similar to crystalline grains. Outside the channel, they keep their height, but their concentration is several times higher.

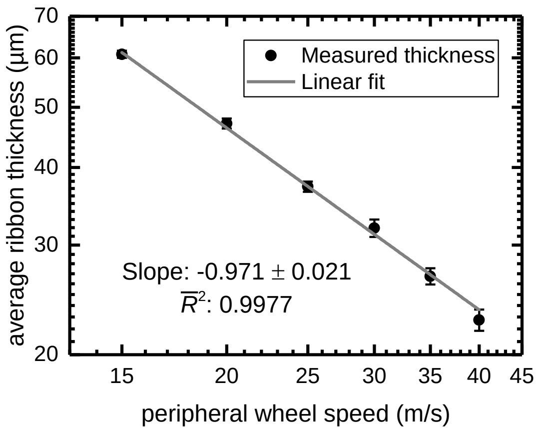

Fig.1:*A log-log plot of d=f(v).*

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