## Nanocomposites and nanomaterials

# The thermal and stress effect on crystallization processes in Co-Fe-Ni-Si-B films, obtained by the splat-quenching

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Amorphous and nanostructured magnetic materials have an important place among metallic materials due to their excellent combination of soft magnetic properties, high values of corrosion stability and electrical resistivity with small dimensions. The enhanced magnetic softness is usually achieved by appropriate treatments and formation of nanocrystalline structure. The aim of this work is to investigate the effect of thermal treatments such as conventional annealing and annealing under tensile stress on crystallization processes in Co-Fe-Ni-Si-B films.

It was found that initial $Co_{67.2}Fe_{6.1}Ni_{10}Si_{11}B_{15.9}$ films obtained by the splat–quenching method (dimensions: 2 mm wide and 20-40 μm thick) have amorphous structure. XRD patterns showed some diffusive haloes which are an inherent feature of disordered structures. Size of the coherently diffracting domains derived from Scherer's equation was approx. 2 nm. The crystallisation of amorphous films occurs in temperature range 480 – 510 °C (5 min). In the first stage, only primary β-Co(B) crystals appears in residual amorphous matrix. The annealing at the temperature 550 °C (5 min) leads to the decomposition of residual amorphous phase. In the second one, metastable phase $(Co,Si)_3B$ (structure type $Fe_3C$) is formed. The annealing under tensile stress in this temperature interval 480 – 570 °C (5 min) did not alter the films structure. Size of the coherently diffracting domains increased slightly up to 3 nm. Annealing under tensile stress increased the thermal stability of amorphous phase. The crystallisation processes begins at temperature up to 570 °C, that expands the thermal interval stability of amorphous phase on 80-100 °C. It is possible that stress annealing stimulates the processes of amorphous phase separation into two phase with different short order and following formation of the phase mixture (β-Co(B) и $(Co,Si)_3B$) through eutectic crystallization. .