

## Amorphous $\text{Fe}_{72}\text{Cu}_1\text{V}_4\text{Si}_{15}\text{B}_8$ Ribbon as Magneto-Impedance Sensing Element

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**Abstract:** Magneto-impedance (MI) effect in the  $\text{Fe}_{72}\text{Cu}_1\text{V}_4\text{Si}_{15}\text{B}_8$  amorphous ribbon obtained by melt spinning method has been studied. The aim of study was the characterisation of this ribbon in as-cast state in terms of its application as a MI sensor. The experiments on MI elements were performed in the frequency range from 30 kHz to 300 MHz and maximum external magnetic field up to 28.6 kA/m. Maximum observed MI-ratio ( $\Delta Z = Z(0) - Z(H_{\max})$ ,  $H_{\max} = 28.6$  kA/m) has amounted to  $\Delta Z/Z(H_{\max}) = 173\%$  at a frequency of 20.46 MHz. The MI curve measured up to 20 MHz shows some shoulder indicating the growth of rotational contribution of magnetization that appears above the domain wall relaxation frequency. The MI profile at frequencies higher than 30 MHz, exhibits a clear peak positioned at transverse anisotropy field  $H_k$ , suggesting domination of rotation magnetization in transverse permeability. The linearity in the range up to 5 kA/m with sensitivity of about 11 %/kA/m was observed.

**Keywords:** MI effects, MI sensors, Amorphous alloys, Magnetic field.

### 1 Introduction

Very interesting phenomena observed in amorphous soft magnetic materials (ribbons/wires or thin films) is magneto-impedance (MI) effect. This effect is manifested by significant changes in the impedance of MI-element under the influence of an external dc magnetic field ( $H$ ). If magneto-impedance ratio is higher than 100 % it is giant magneto-impedance (GMI) effect. MI effect was discovered in the early nineties of the twentieth century [1] and nowadays it is used for making a very sensitive magnetic field sensor whose sensitivity reaches up to about 7%/(A/m) [1 – 4]. Similar effect is giant magneto-resistive (GMR) effect with the changes of electrical resistance but with lower sensitivity of about 0.0125 %/(A/m) [4]. It should be noted that there are substantial differences in the origin of magneto-impedance compared to the magneto-resistance (MR) effect [5]. MI and MR effects are used for monitoring

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