# Microstructure of Nb/CuNi Nanostructures

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***Abstract* — Results of High Resolution Transmission Electron Microscopy (HRTEM) and scanning Auger Electron Spectroscopy (AES) results for CuNi/Nb/CuNi nanostructures prepared by magnetron sputtering are presented and discussed .**

***Index Terms* — Auger spectroscopy, electron microscopy, spintronics, superconductivity, proximity effect.**

## I. INTRODUCTION

Superconducting hybrids based on thin films are the object of intense investigations for recent decades as a base element for spin-sensitive superconducting electronics, spintronics [1]. The investigations of proximity effect at Superconductor-Normal metal (S/N) and Superconductor-Ferromagnet (S/F) interfaces require technological approach with high quality superconducting films at constant thicknesses and enhanced superconducting properties. We developed technological approach yields significant improvement of fabricated SF hybrids, based on the most promising for superconducting spintronics applications materials - Nb and ferromagnetic alloy CuNi of nanoscale thickness, based on DC-magnetron deposition.

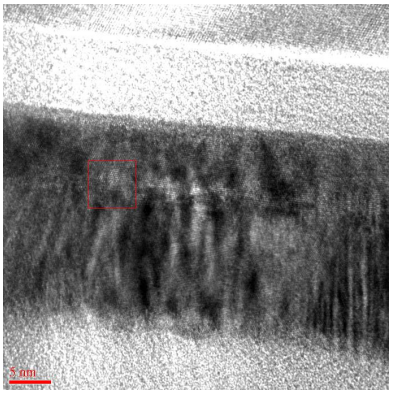


Fig 1. HRTEM image of the cross section of Nb/CuNi sample on the silicon (100) substrate. For details see text.

There is a very important to gain knowledge about intrinsic properties of the layers, taking into account the perspectives of use these CuNi/Nb/CuNi structures for design of spintronic devices. In this work we present results of High Resolution Transmission Electron Microscopy (HRTEM) and Scanning Auger electron spectroscopy (AES) results for CuNi/Nb/CuNi samples prepared by magnetron sputtering, the procedure described in [2].

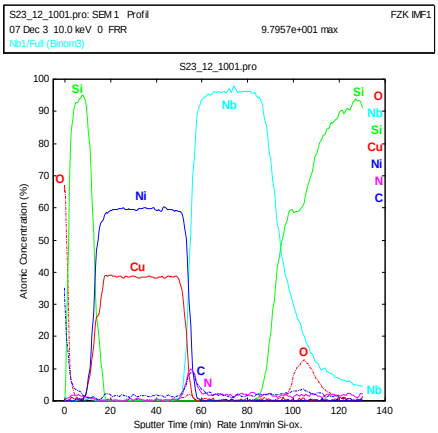


Fig 2. Scanning Auger electron spectroscopy (AES) of a Si(substrate)/Si(buffer)/Nb/$Cu_{1-x}Ni_x$/Si(cap) sample.

## II. RESULTS AND DISCUSSION

Figure 1 demonstrates the cross section analysis of one of the samples on the atomic scale and the Figure 2 - Scanning Auger electron spectroscopy of the same sample. The interface area, marked in the image with a red quadrat, was analized using a Fast Fourier Transformation of a diffraction patterns obtained. The diffraction points were masked with the help of a computer program and the background noise is substracted. One can clearly see the regular crystal structure of the BCC Niobium and FCC lattice structure of Copper Nickel layer and a very sharp and clean interface between the two layers in the area near the red quadrat, one can see that the $Cu_{1-x}Ni_x$/Si(cap) interface is free from contaminations.

## III. CONCLUSION

The quality of the layers, Nb and CuNi, and the clean interface between the layers allows to develop the three-layers core-structure CuNi/Nb/CuNi, necessary for design of superconducting spintronic device, spin-valve.

## ACKNOWLEDGMENTS

The work was supported by DFG grant AOBJ: 573661 and AvH grant DEU/1009845 “Nonuniform superconductivity in layered SF-nanostructures Superconductor/Ferromagnet”, by the A.v.Humboldt Foundation the AvH-Project 2C0704 "Nonuniform superconductivity in layered SF-nanostructures Superconductor/Ferromagnet" and Moldavian State Program Grant 11.836.05.01A.

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