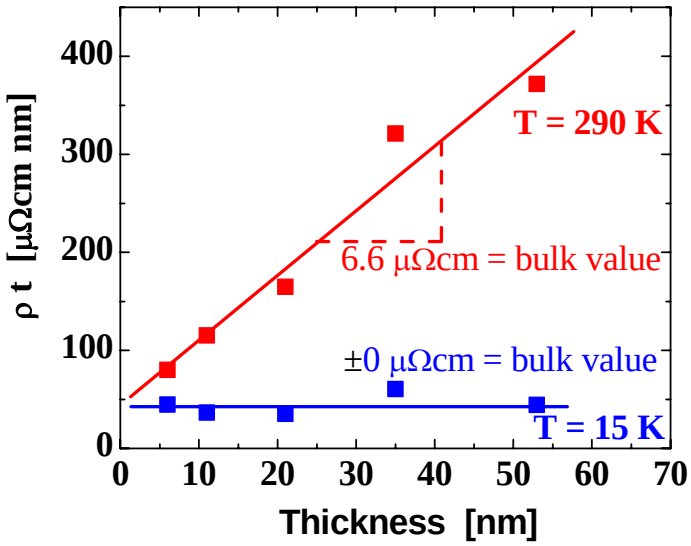

The figure shows electrical resistivity data at room temperature (red) and low temperature (blue). The slop of the respective lines represents the bulk resistivity value which is essentially zero at low temperature indicating the absence of defects in these films.

Very low defect density in electroplated epitaxial Ni films

Electrodeposition technique was used to grow epitaxial Ni(111) epitaxial films on GaAs(110) and resistivity measurements were performed as a function of film thickness. The phenomenological Fuch's model was used to analyze the data which describes the transport properties in terms of a surface and a bulk contribution to electron scattering. As shown in the figure, the slope of a straight line fit to the data corresponds to the bulk-resistivity which is the resistivity of the film assuming the surfaces would not scatter the electrons. Thus this value is a measure for electron scattering in the interior of the film and thus the value for a very thick film.
The bulk resistivity value at room temperature (red data) is close to the literature value for Ni whereas the low temperature (blue data) bulk resistivity value is 0.1 μΩcm or less. This indicates very low intra-layer electron scattering and thus a very low defect density due to the high quality of the epitaxial growth. Such a low bulk resistivity value normally is found only for films prepared under the cleanest vacuum conditions using Molecular Beam Epitaxy.

This achievement could be transferred to electrodeposition of other metals which could result in a better control of electromigration in integrated circuit interconnects. This research was carried out in the EPSCoR state of Alabama.

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