
## Abstract

The scientific developments in fields of materials and engineering sciences requires uplifted properties of fabricated materials. Miniaturizing of materials has been adopted widely to incorporate new set of technologies. This significant progress focuses on efficiency and economical versions of new systems and devices in order to compete the demands and structures. Thin films fabrication and characterization has an astounding evolution after a long theoretical research breakthrough at sub atomic level.

This research work has been presented in domain of experimental plasma physics. Concern and aim of this research is to probe the physical properties of Nickel-Iron silicides in thin film structures. Perm alloy ($Ni_{80}Fe_{20}$) is an intermetallic alloy of transition elements with respective composition. It significantly possess ferromagnetic properties and extensively utilized in motors, actuators and storage devices. Nickel-Iron silicide thin films have been synthesized by numerous techniques with different parameters and characterizations to study their properties. While in current experimental work, Mather-type dense plasma focus (DPF) system has been employed to deposit the target material (nickel-iron alloy) on silicon substrate. This is work has been identified first for the surface modification of silicon with Py alloy by utilizing DPF system. Configuration and dynamics of dense plasma focus system has also been described. In this experiment task, six silicon samples were finely processed by focus shots in DPF. Optimum conditions were devised by control parameters to achieve maximum growth of thin films on substrate surface. Furthermore, imperative properties of the materialized thin films were characterized which includes XRD for structural analysis, SEM for morphological analysis, four probe (FPP) for electrical resistivity study and VSM for study of magnetic properties.

In general, XRD results presented a polycrystalline nature of thin films with strong dependence of crystalline size on plasma focus shots. While SEM images illustrated the granular structures of intermetallic silicide thin films and its cross section implicated the thickness of grown films. Four points probe (FPP) analysis characterized the thin films in semi-conductive range for given number of focus shots. On the other side, parametric analysis of hysteresis loops by VSM showed relatively dominant ferromagnetic behavior of given samples for corresponding number of plasma shots.