List of Figures

1.1 Pictorial representation of substitutional and interstitial alloys ............. 2
1.2 Energy dependence of inelastic mean free path of electron in solids ............. 5
1.3 Sketch showing the basic components for Photoemission experiment ............. 5
1.4 Layout of a Photoelectron Spectrometer ........................................ 6
1.5 Steplike background in XPS spectrum ........................................... 9
1.6 X-ray Photoemission and Auger Processes ....................................... 10
1.7 Relative yields of K-Auger and K-X-ray fluorescence ......................... 10

2.1 Experimental setup of arc-melting technique present at UGC-DAE CSR, Indore . . . . 22
2.2 Photoelectron Spectroscopy (PES) machine present at TIFR, Mumbai ............. 25
2.3 Sample holder along with samples mounted in PES machine present at TIFR, Mum-
    bai. Diamond scrapper used for in-situ surface cleaning is also seen ............. 26
2.4 (a) Fermi edge of clean Ag recorded using monochromatic AlKα radiation and (b)
    Differential of the Fermi edge shown in panel (a) and its numerical fit using Gaussian
    function ................................................................. 27
2.5 Ag3d_{5/2} of clean Ag recorded using monochromatic AlKα radiation and its numerical
    fit using Doniach-Šunjić function. ...................................... 28
2.6 Survey scan taken on Cu before and after scrapping using monochromatic AlKα radi-
    ation ................................................................. 29
4.6 Spectra shown in Fig. 4.4 are aligned in energy to that of pure Ag to emphasize broadening effect ................................................................. 53

4.7 Bulk and surface components of Ag 3d$_{5/2}$ in Ag$_{1-x}$Pd$_x$ alloys .................. 54

4.8 Pd 3d$_{5/2}$ spectra of Ag$_{1-x}$Pd$_x$ alloys excited by monochromatic AlK$_\alpha$ .......... 55

4.9 Composition dependence of Pd 3d$_{5/2}$ in Ag$_{1-x}$Pd$_x$ alloys ......................... 55

4.10 Spectra of Ag$_{0.95}$Pd$_{0.05}$ and Ag$_{0.75}$Pd$_{0.25}$ are aligned to emphasize broadening effect . 56

4.11 Bulk and surface components of Pd 3d$_{5/2}$ in Ag$_{1-x}$Pd$_x$ alloys ................... 56

5.1 Cu L$_3$M$_{4.5}$M$_{4.5}$ Auger peak of Cu$_{1-x}$Ni$_x$ alloys excited by monochromatic AlK$_\alpha$ radiation ................................................................. 62

5.2 Composition dependence of Cu L$_3$M$_{4.5}$M$_{4.5}$ Auger shifts of Cu$_{1-x}$Ni$_x$ alloys . . . 62

5.3 Cu L$_3$M$_{4.5}$M$_{4.5}$ Auger spectra of Cu$_{1-x}$Ni$_x$ alloys aligned in kinetic energy of pure Cu Auger ................................................................. 63

5.4 Ag M$_{4.5}$N$_{4.5}$N$_{4.5}$ Auger profiles of Ag$_{1-x}$Pd$_x$ alloys excited by monochromatic AlK$_\alpha$ radiation ................................................................. 67

5.5 Ag M$_{4.5}$N$_{4.5}$N$_{4.5}$ Auger transition along with Ag 3d core level of pure Ag excited by monochromatic AlK$_\alpha$ radiation. Ag 3d core level is shifted in kinetic energy to align with the Auger transition ................................................................. 67

5.6 Ag M$_{5}$N$_{4.5}$N$_{4.5}$ Auger feature along with Ag 4d band of pure Ag excited by monochromatic AlK$_\alpha$ radiation. Ag 4d band is shifted in kinetic energy to align with the Auger transition ................................................................. 68

5.7 De-convolution of Ag MVV Auger spectra of Ag$_{1-x}$Pd$_x$ alloys using Gaussian-Lorentzian sum function, BG indicates Shirley background .................. 69

5.8 (Colour online) Ag M$_{5}$N$_{4.5}$N$_{4.5}$ Auger feature of (a) Ag$_{1-x}$Pd$_x$ alloys showing the shift and (b) pure Ag and Ag$_{0.75}$Pd$_{0.25}$ alloy aligned to the same kinetic energy to show the broadening effect ................................................................. 71
5.9 (Colour online) Pd M_{4.5}N_{4.5} Auger feature of pure Pd, Ag_{0.75}Pd_{0.25} and Ag_{0.85}Pd_{0.15} alloys excited by monochromatic AlK\(_\alpha\) radiation. Spectra have been shifted vertically for clarity.

5.10 Ag M_{4.5}N_{4.5} Auger kinetic energy shift(\(\Delta\)) in Ag\(_{1-x}\)Pd\(_x\) alloys with Pd concentration, \(x\). Solid line represents the numerical fit to the experimental data using the equation, \(\Delta = 0.54x^{1/2}\).

6.1 XRD pattern of as deposited Cu/Ni/Si(100) and the inset shows the AFM topography.

6.2 Magnetic hysteresis of Cu/Ni/Si(100) and the inset shows the temperature dependence of magnetization.

6.3 (a) Cu 2p spectra of as deposited and sputtered Cu/Ni/Si(100) and (b) Ni 2p spectrum of Cu/Ni/Si(100) after 40 min sputtering.

6.4 (a) Cu 2p\(_{3/2}\) spectra of Cu/Ni/Si(100) sputtered for (1) 10 min (2)20 min and (3) 40 min. Dots represents the experimental data and the solid line indicates the numerically fitted Doniach-Šunjić line shape in each case (b) Cu 2p\(_{3/2}\) peak of unsputtered Cu/Ni/Si(100) along with the numerical deconvolution of peaks.

6.5 Cu 2p\(_{3/2}\) core level of Cu surface (10 min sputtered) and Cu/Ni interface (40 min sputtered) Cu/Ni/Si(100).

6.6 AFM topography and line profile of as deposited Cu/Ni/Si(100).

6.7 AFM topography (1000 nm × 1000 nm) of (a) 10 min (b) 20 min sputtered Cu/Ni/Si(100) and their line profiles ((a') and (b')).

6.8 Ion implantation profile (dot) calculated using SRIM software and the numerical fit (line) using Gaussian function.