Photoemission studies of amorphous Gadolinium-Iron interface

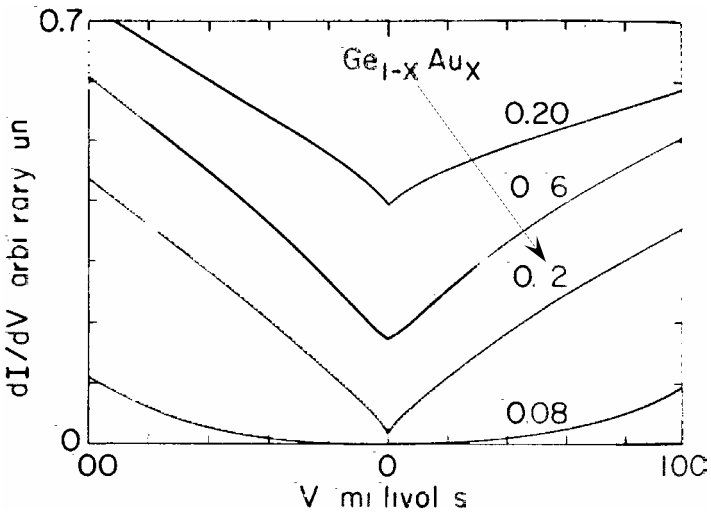
/Search for the soft gap at the Fermi level in disordered materials/

- **Idea; Tunneling experiments**
- **Photoemission studies, problems**
- **Results, metal glass, Gd-Fe**

Tunneling Experiments

W.L. McMillan and J. Mochel, PRL 46, 556 (1981)

Tunneling in amorphous $Ge_{1-x}Au_x$

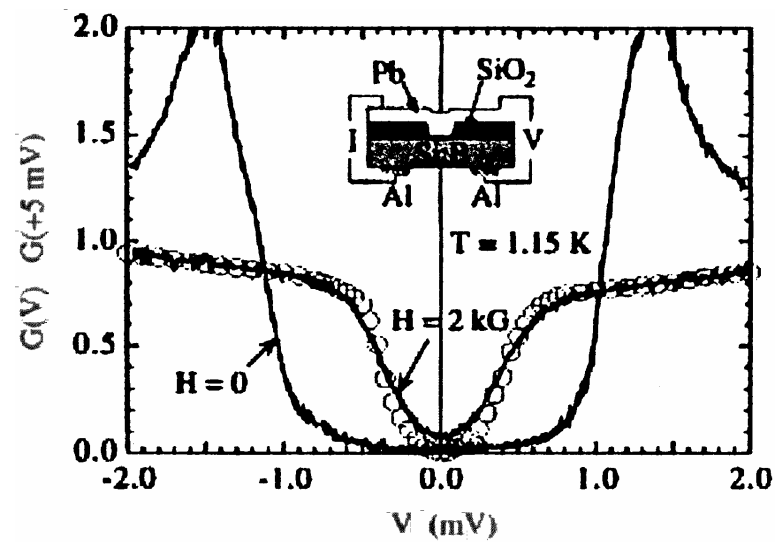


$N(E) \sim N(0)\{1+[(E-E_F)/\Delta]^{\alpha}\}$

$\alpha \sim 0.6$ in agreement with Altshuler and Aronov theory

J.G. Massey and M. Lee, PRL 75, 4266 (1995)

Coulomb gap in nonmetallic semiconductor Si:B

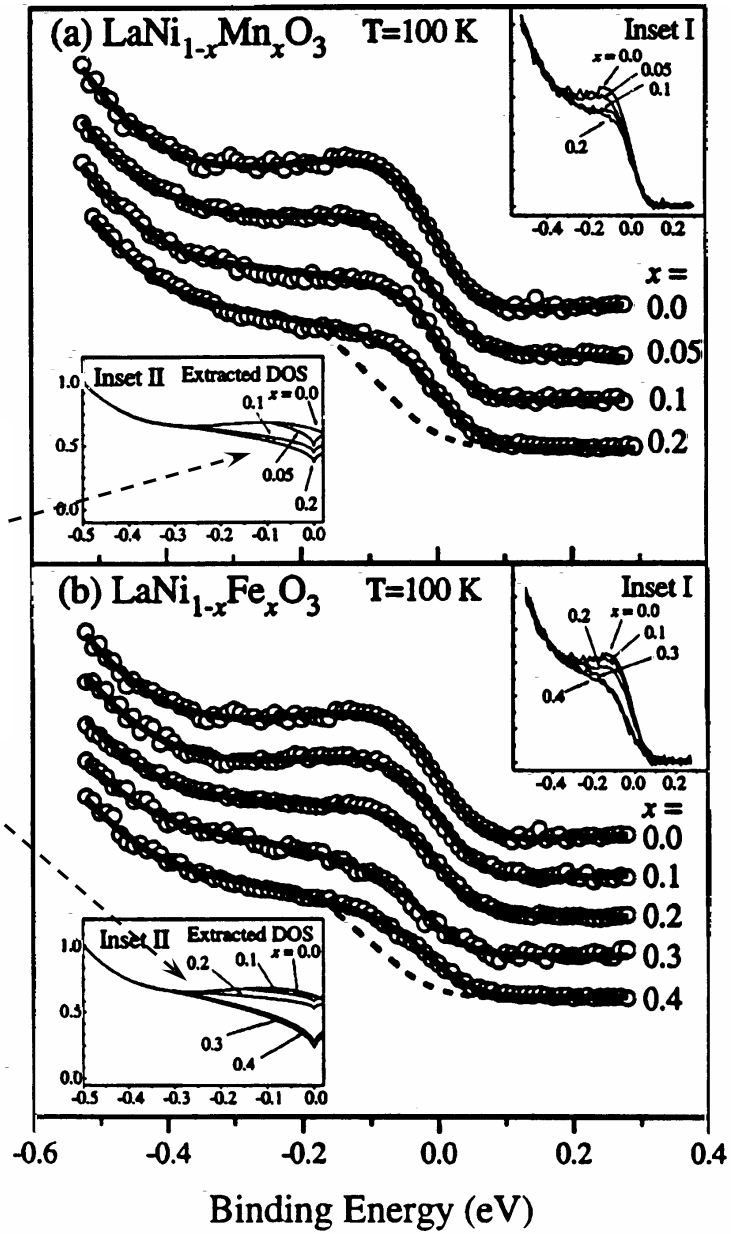


$N(E) \sim (E-E_F)^2$

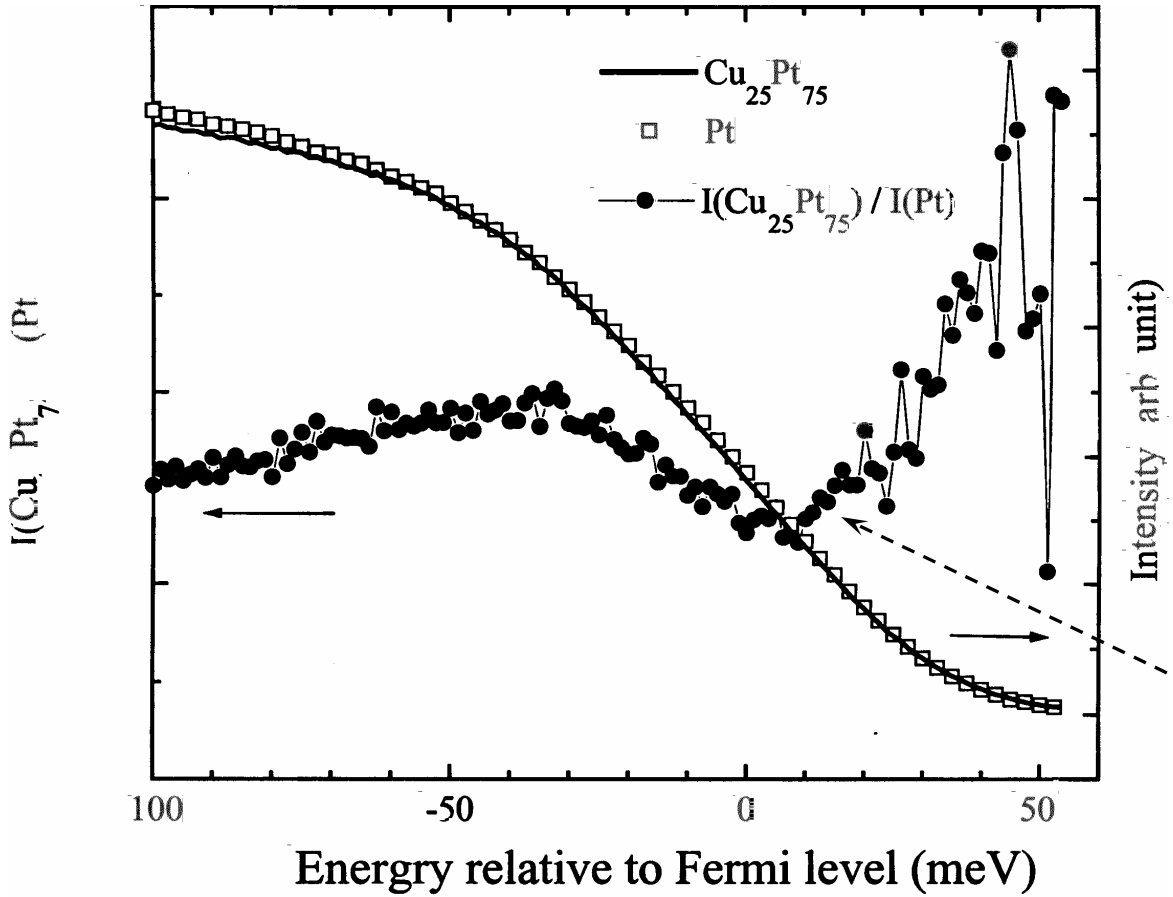
D.D. Sarma et al., PRL 80, 4004 (1998)

Disorder effects in substituted transition metal compounds

$/E-E_F/^{1/2}$ cusp at E_F in agreement with Altshuler-Aronov theory



H.-J. Noh et al., cond-mat/9910411



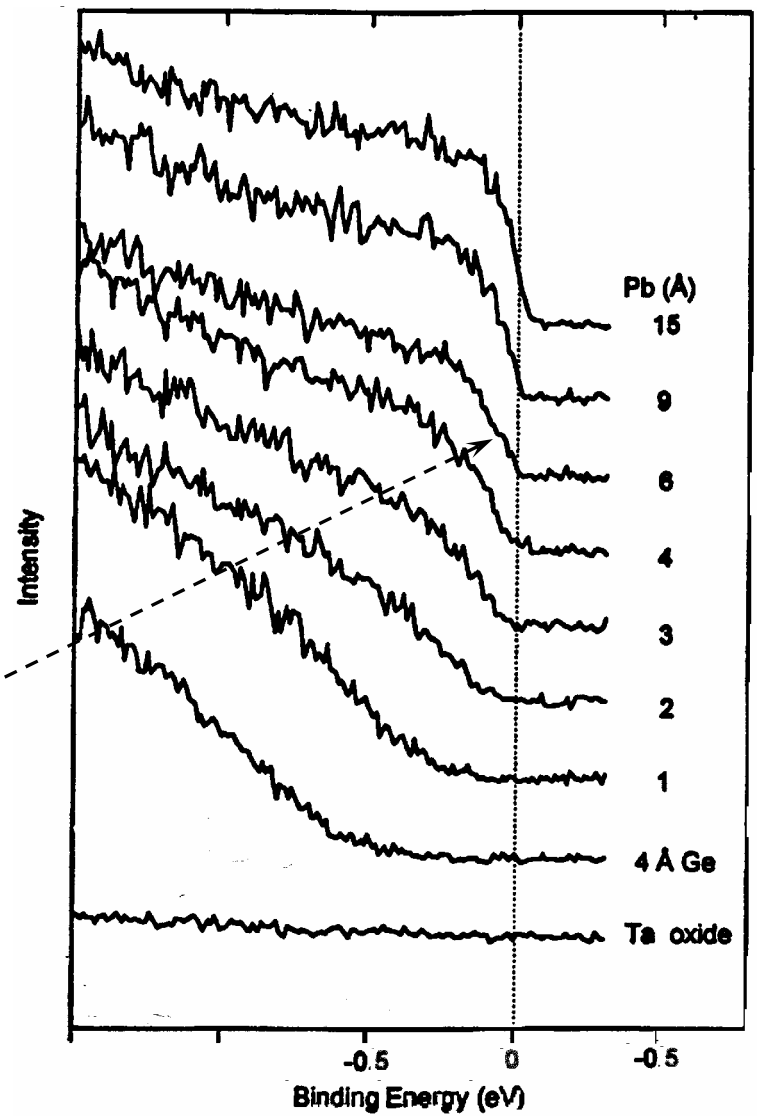
ARPES of disordered 3-D alloys

- "Cusp singularity" in agreement with Altshuler and Aronov theory

D.J. Huang, G. Reisfeld, and M. Strongin, PRB 55, R1977 (1998)

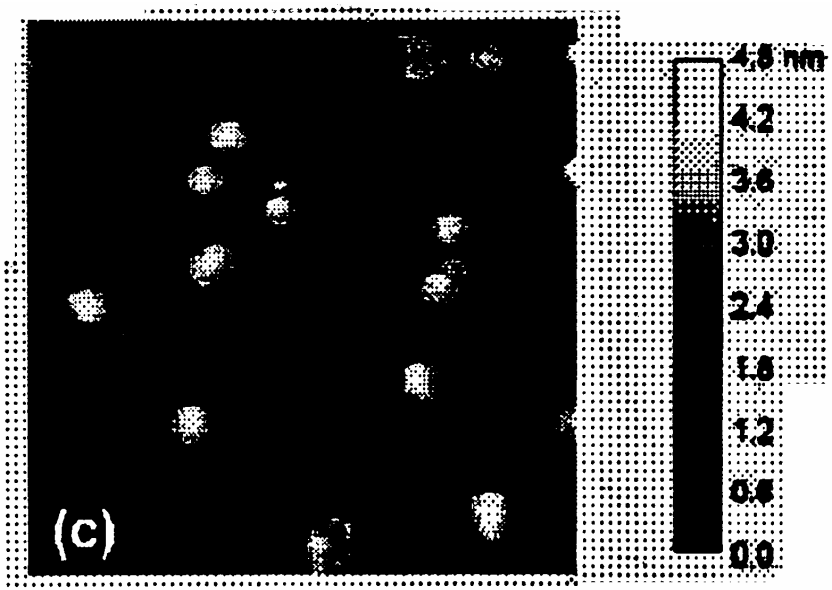
Transition from insulating to metallic state in ultrathin layers /Lead on Germanium/

$g(E) \sim /E-E_F/$
Coulomb gap in two dimensions

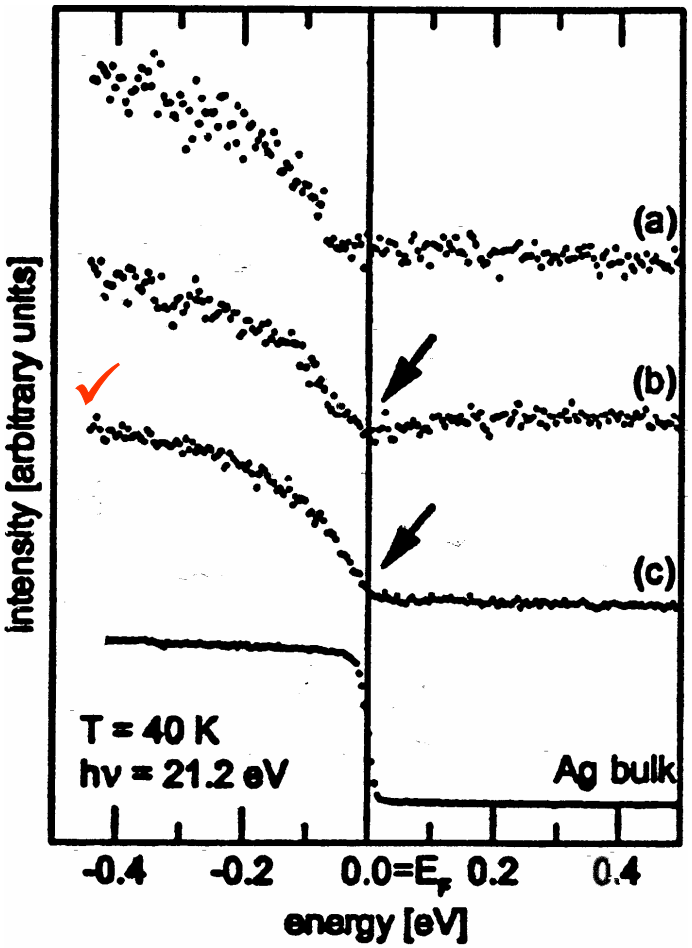


H. Hoevel, B. Grimm, M. Pollmann, and B. Reihl, PRL 81, 4608 (1998)

STM images of 3.9 nm silver clusters on HOPG graphite
4×10^3 atoms in cluster



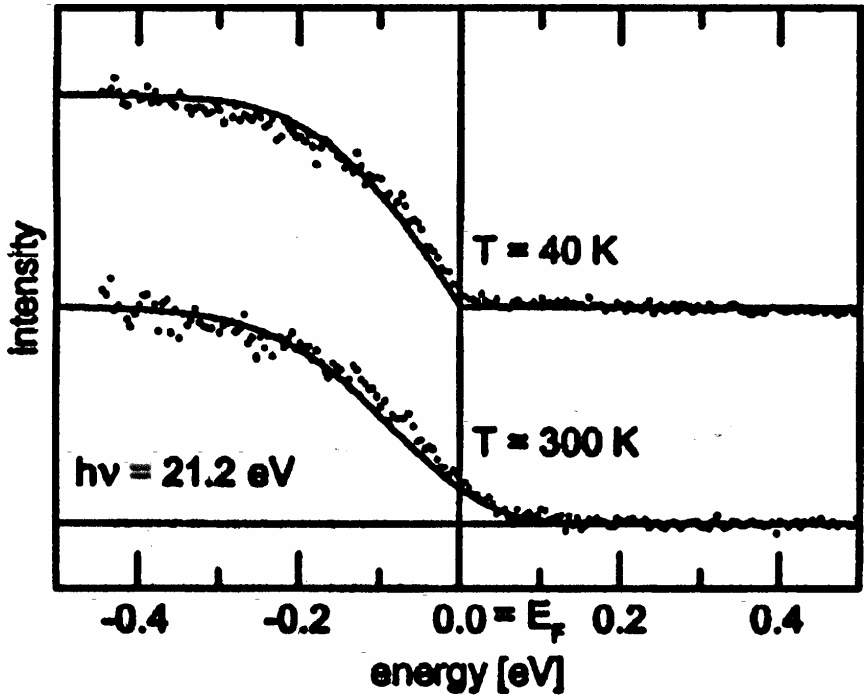
ARPES of clusters at 40 K



$$N(E) \sim \{1-\exp[-C\times E/(W_{max}-E)]\}$$

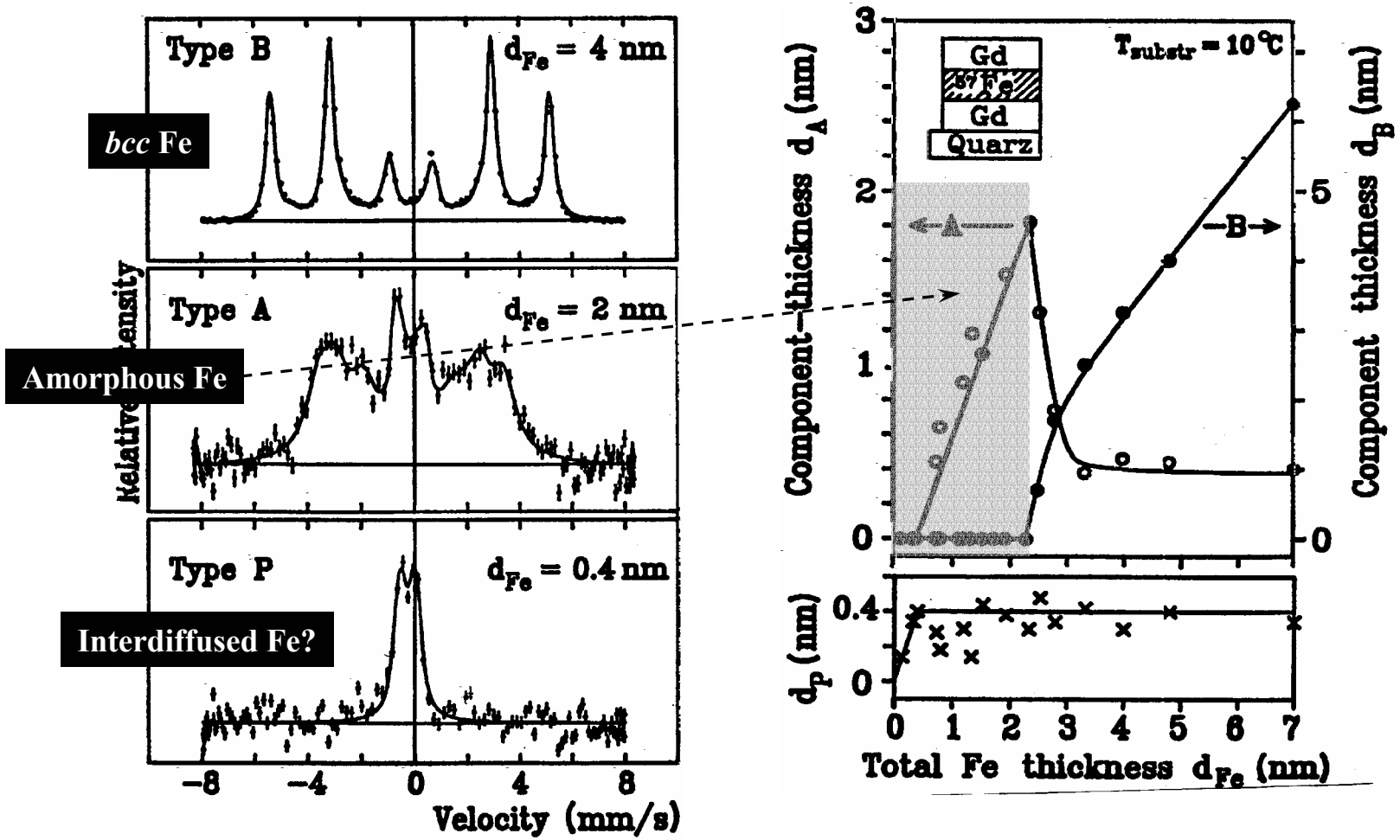
$$W(r) \sim (1/R_{cluster}-1/r)$$

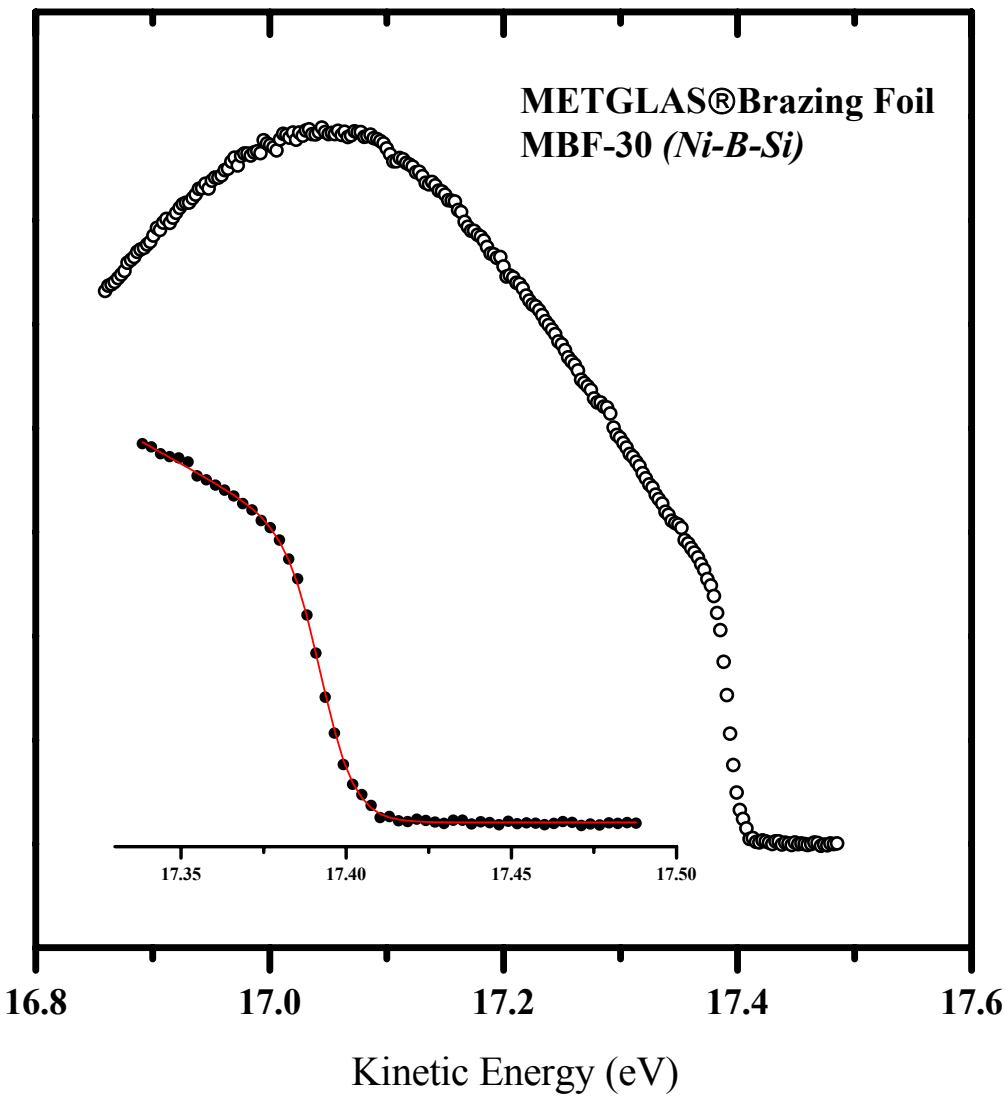
$r \sim v\times\tau$ *(v-velocity; τ-relaxation time)*

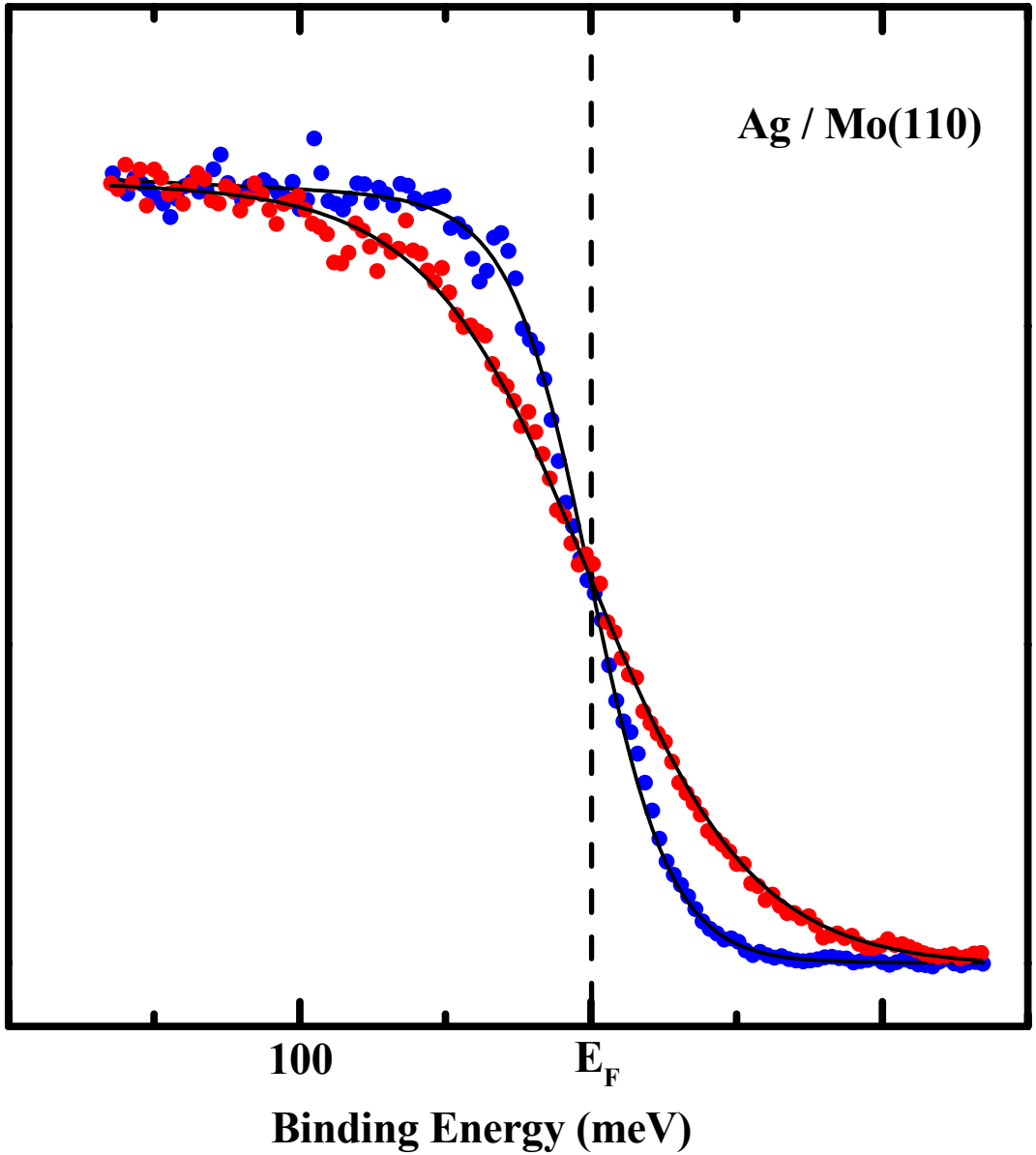


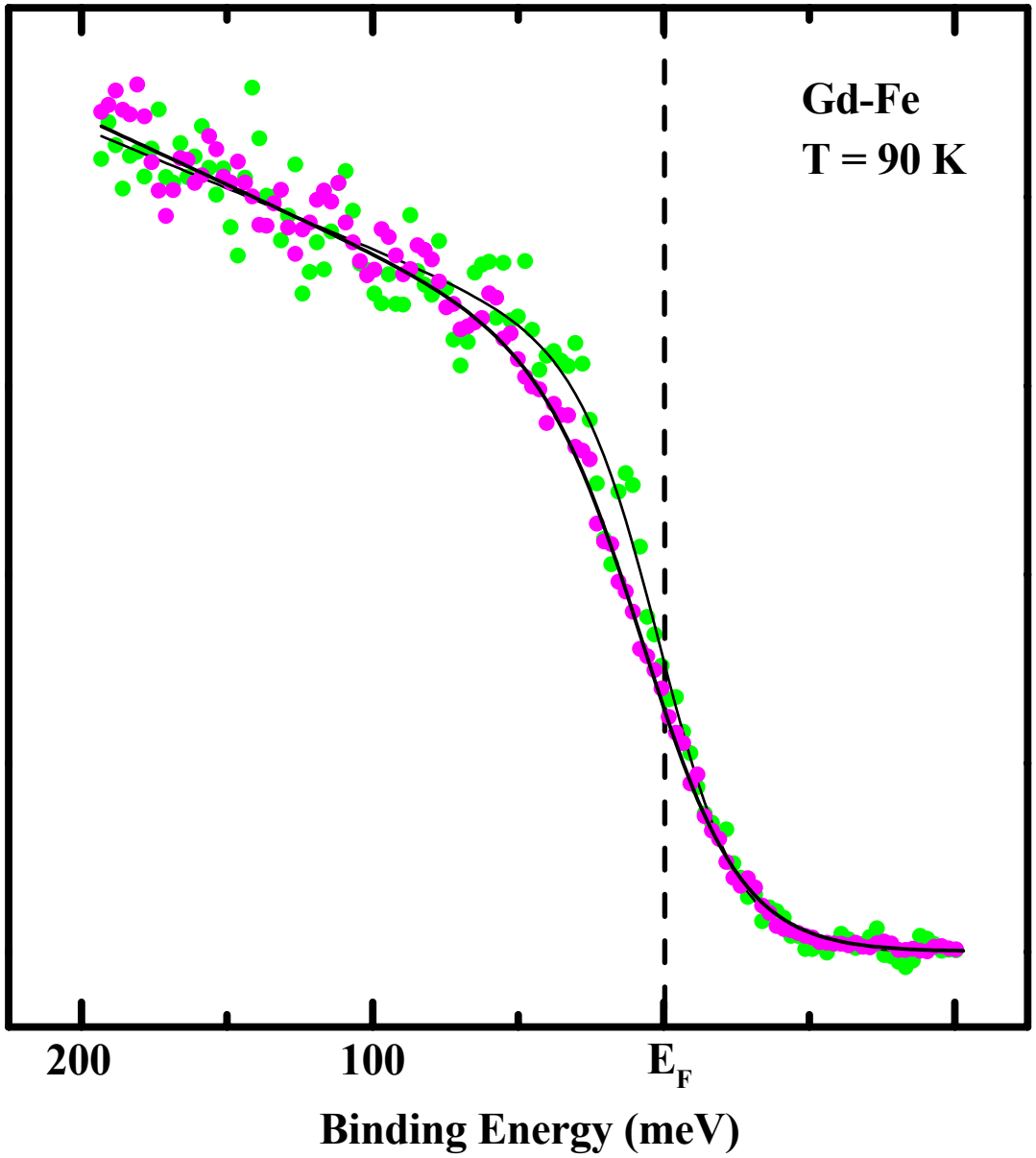
J. Landes, Ch. Sauer, B. Kabius, and W. Zinn, PRB 44, 8342 (1991)

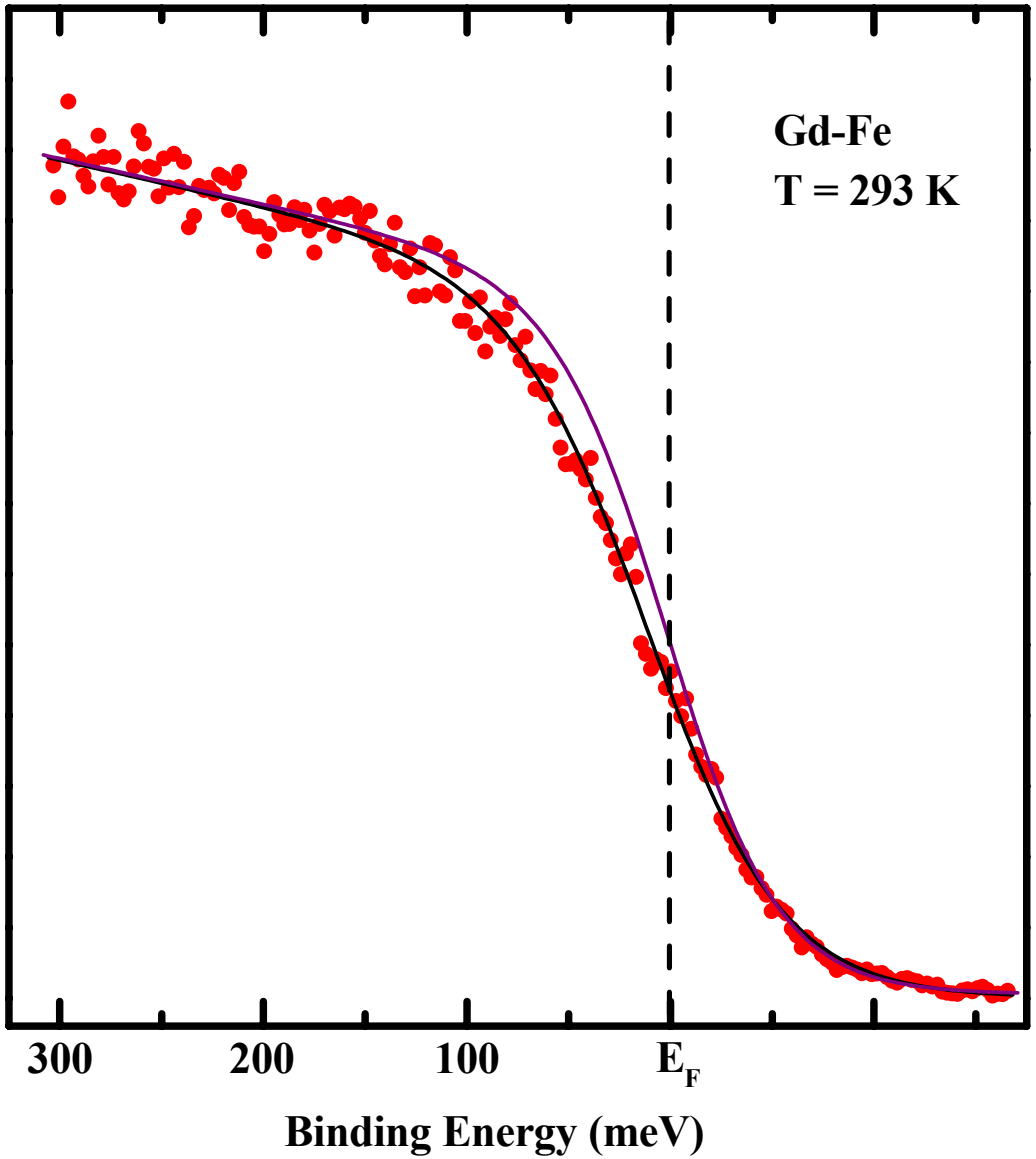
Mössbauer spectroscopy of Gd/Fe interface

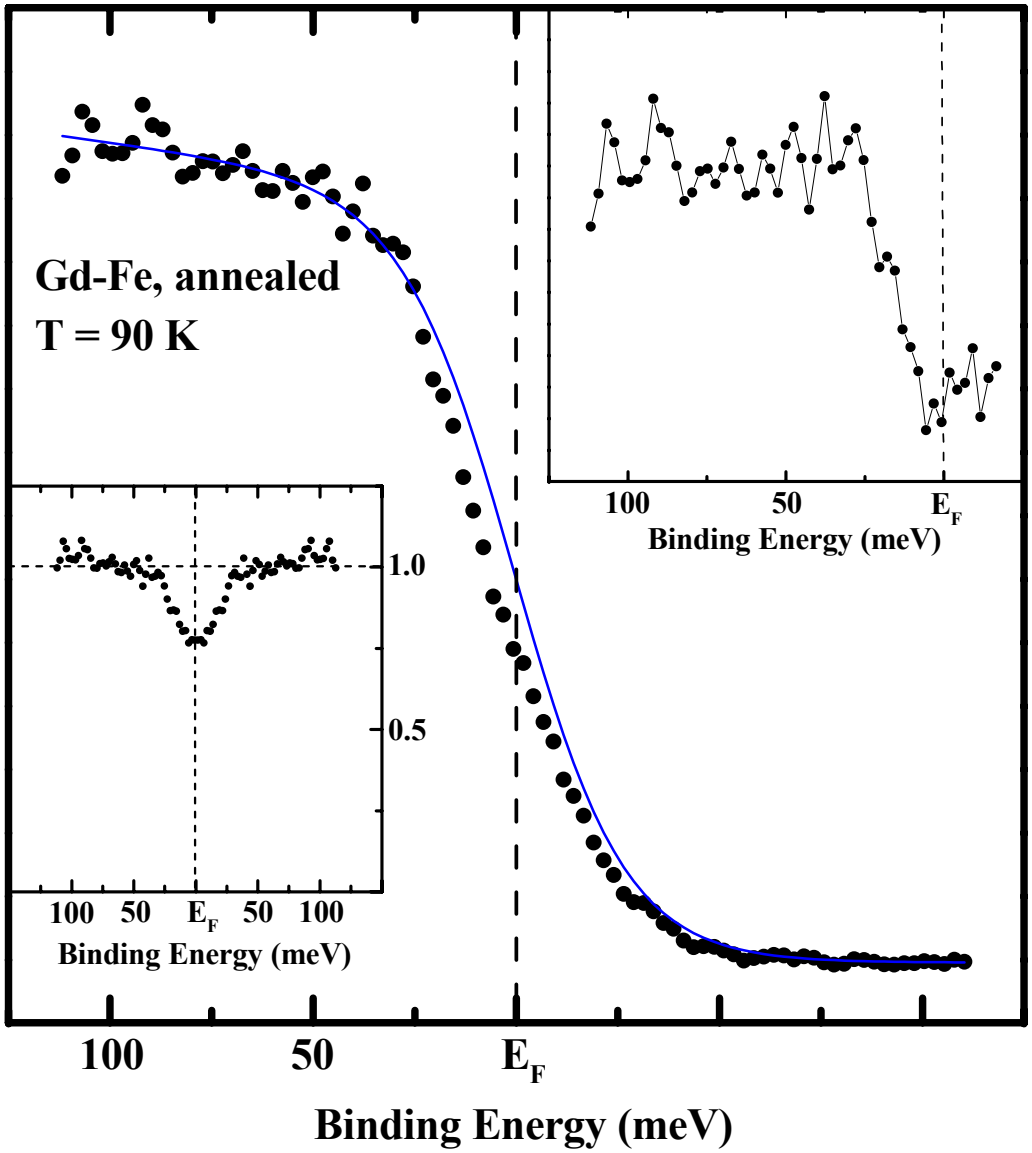


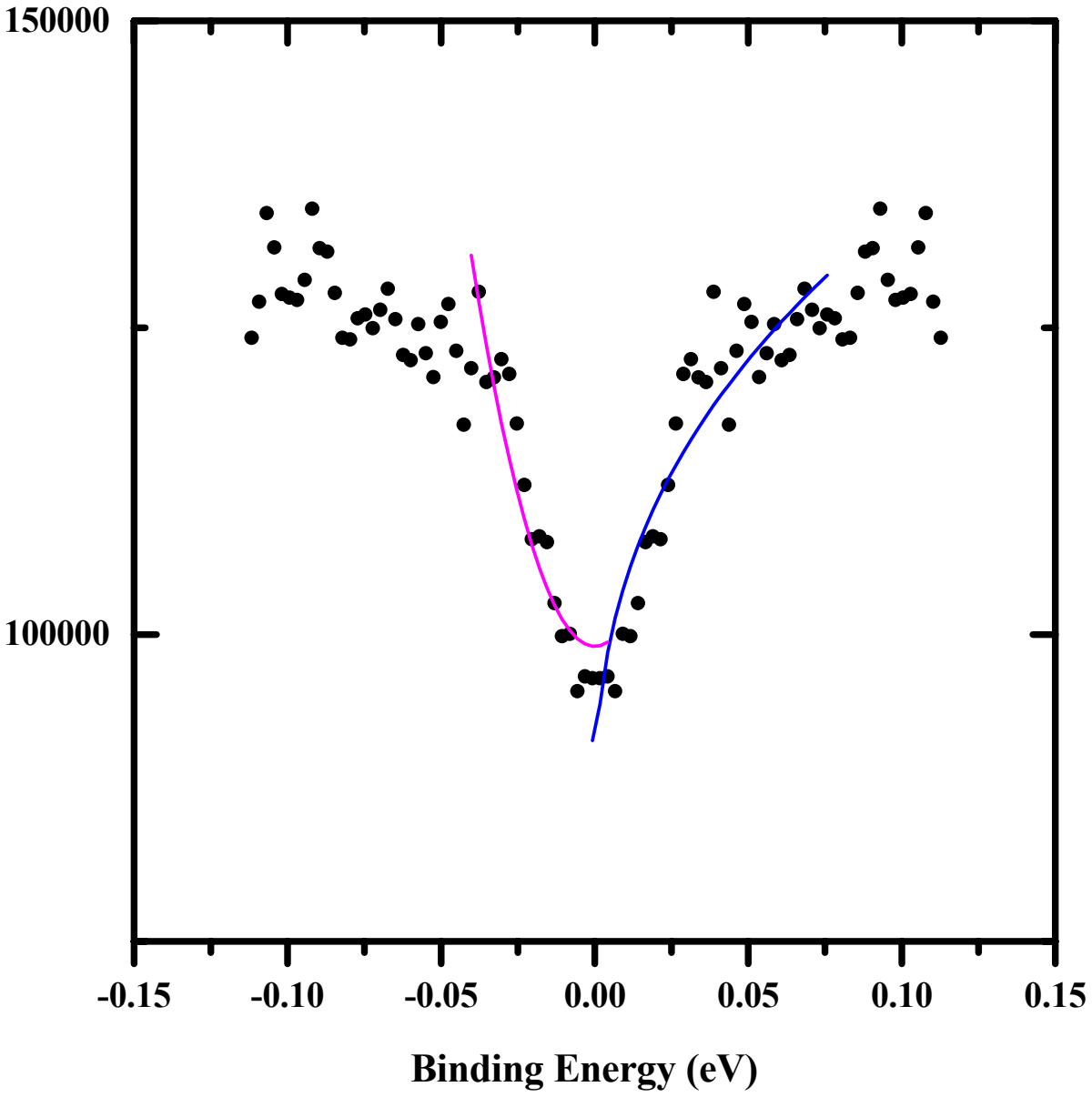

METGLAS®Brazing Foil
MBF-30 (Ni-B-Si)
17.35
17.40
17.45
17.50
16.8
17.0
17.2
17.4
17.6
Kinetic Energy (eV)


Ag / Mo(110)
100
E_F
Binding Energy (meV)


Gd-Fe
T = 90 K
200
100
E_F
Binding Energy (meV)


Gd-Fe
T = 293 K
300
200
100
E_F
Binding Energy (meV)


Gd-Fe, annealed
T = 90 K
1.0
0.5
100
50
E_F
50
100
Binding Energy (meV)
100
50
E_F
Binding Energy (meV)
100
50
E_F
Binding Energy (meV)


150000
100000
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
Binding Energy (eV)