Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supporting Information:

Carrier concentration dependent optical and electrical properties of Ga doped ZnO hexagonal nanocrystals

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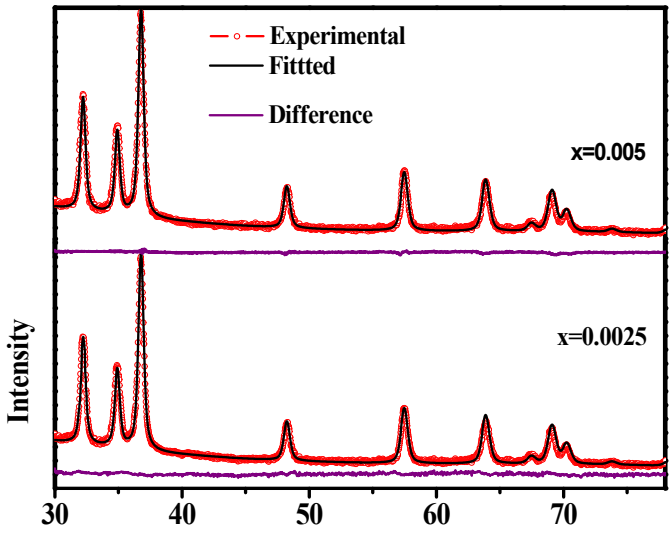

Fig.S1 Rietveld refinements of the X ray diffraction for x=0.0025 and x=0.005 samples

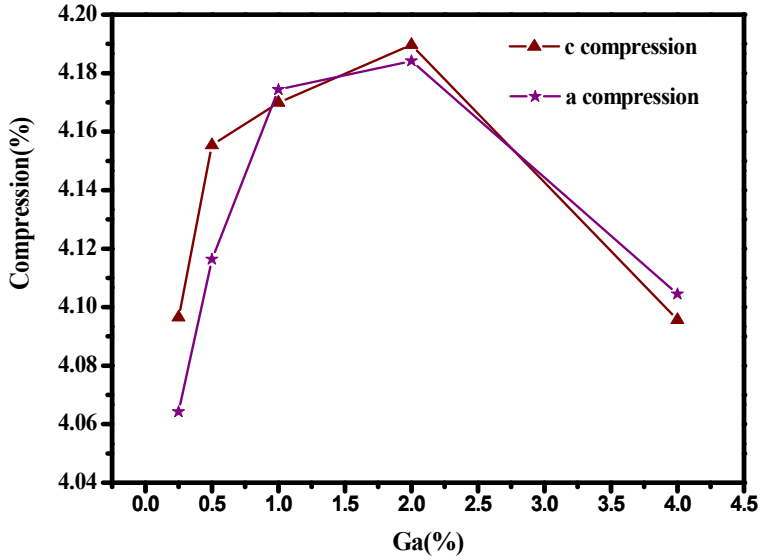

Fig.S2 Compression of lattice parameter in % rather than pure sample with doping mole%.

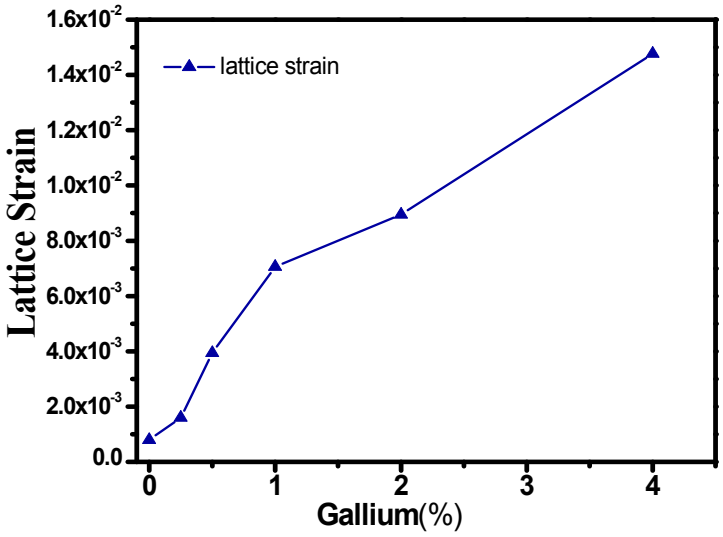

Fig.S3 Lattice strain with doping mole%.

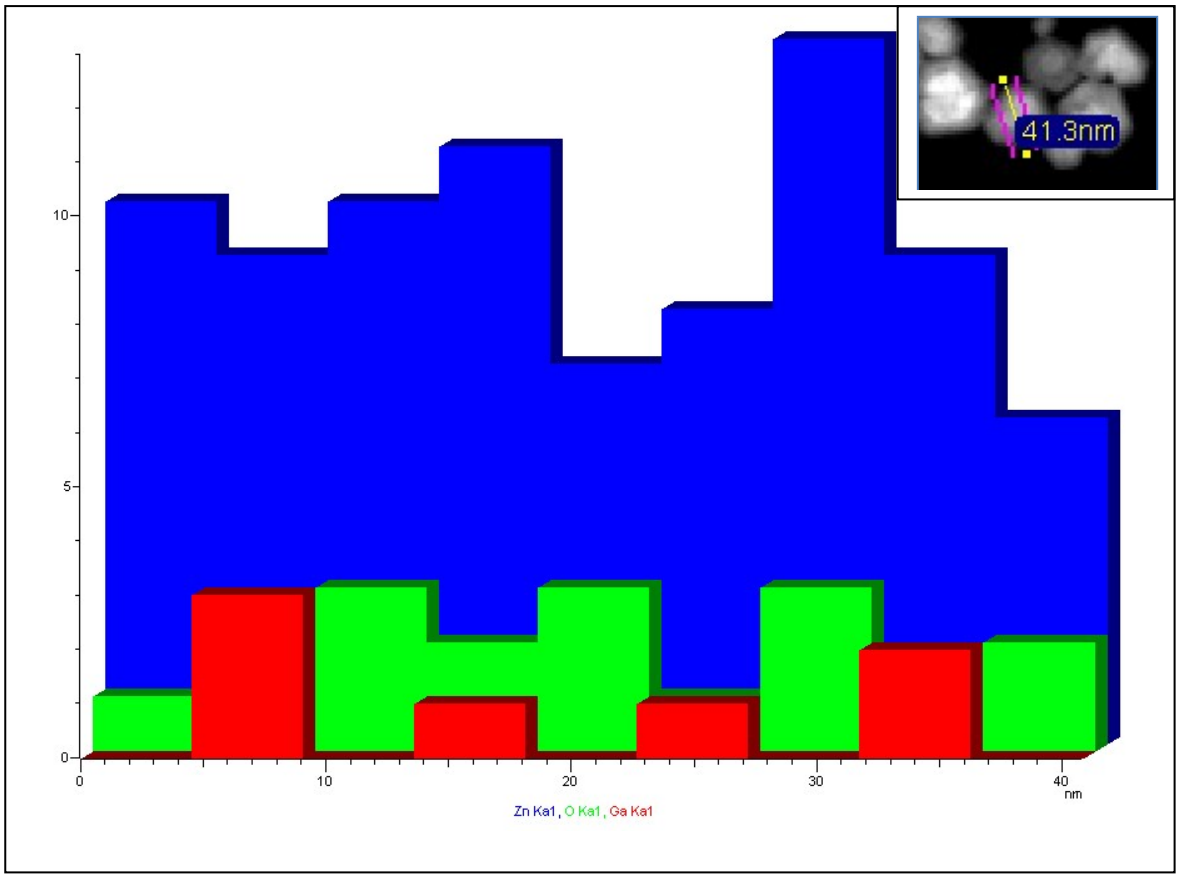

Fig. S4 EDAX line scan for a single 1 mole% Ga doped ZnO nanocrystals. Blue, Green and Red column bars are symbolic for Zn, O and Ga respectively. Homogeneous Dopant distribution was found over 30 nm region. Inset shows the single nanocrystal which was line scanned.

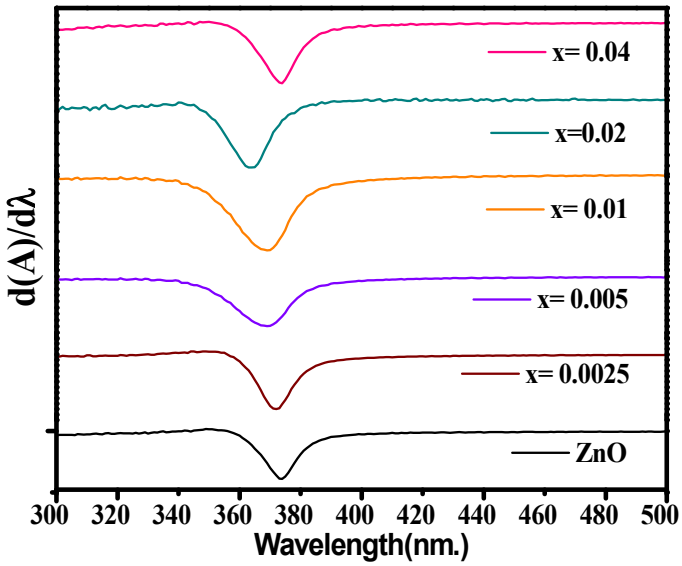

Fig.S5 Differential absorption spectra of pure and doped samples.

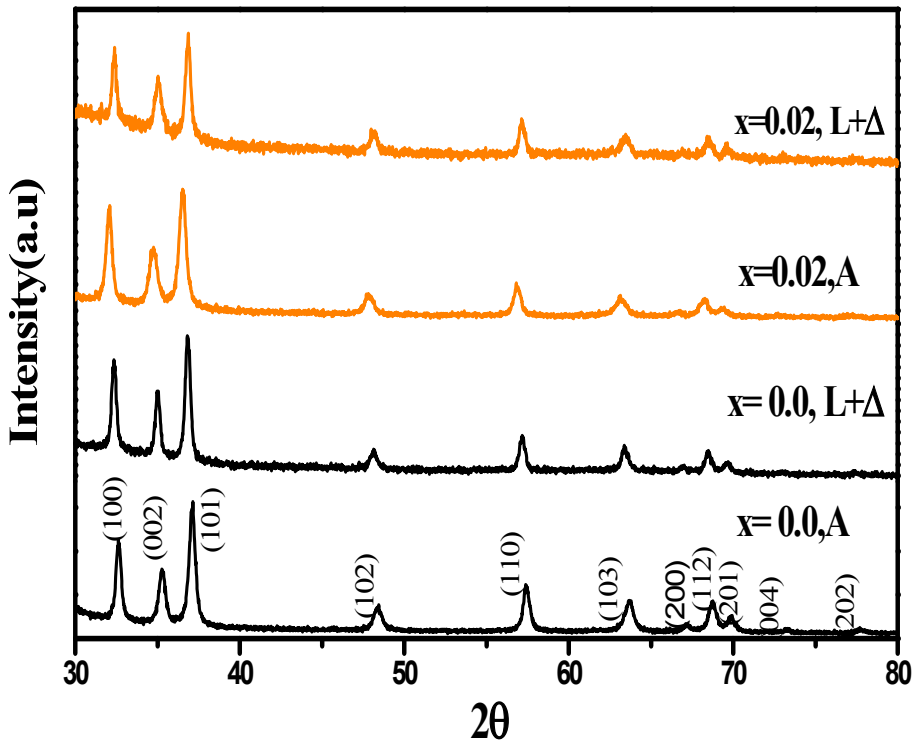

Fig. S6 XRD pattern of as synthesized $Zn_{1-x}Ga_xO$ (x= 0.0 and x= 0.02) film and ligand free heat treated (450˚ C Ar annealed) film on quartz ; A = as synthesized , L+Δ = ligand exchange and heat treated

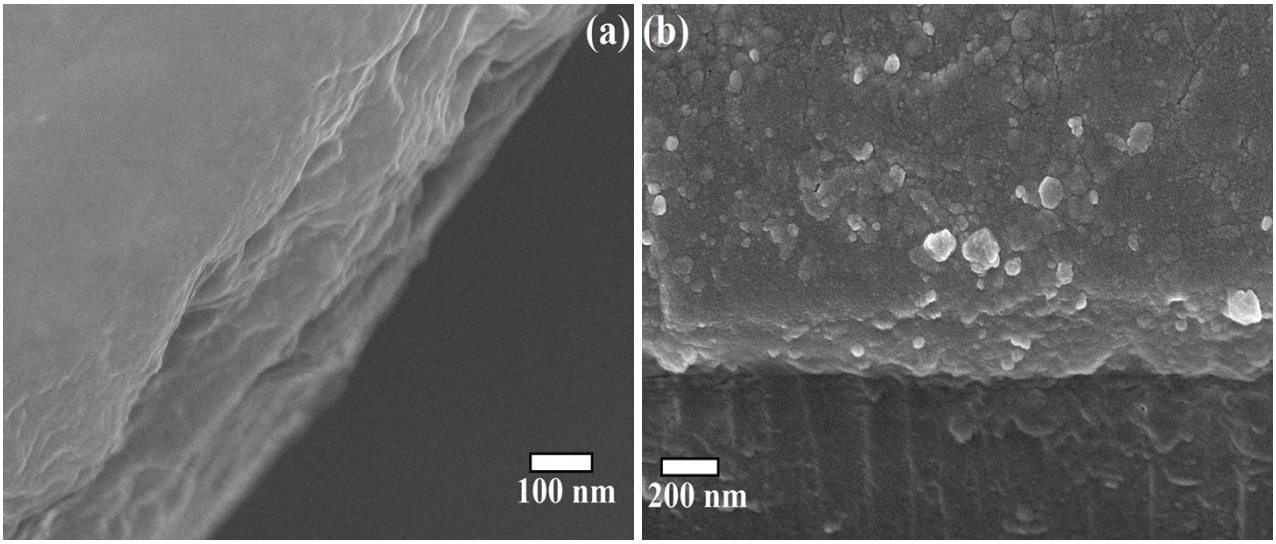

Fig. S7

Fig. S7: (a) Cross section SEM image of as-deposited Ga:ZnO thin film. (b) Cross-section view of annealed thin film shows the uniform nature of film.

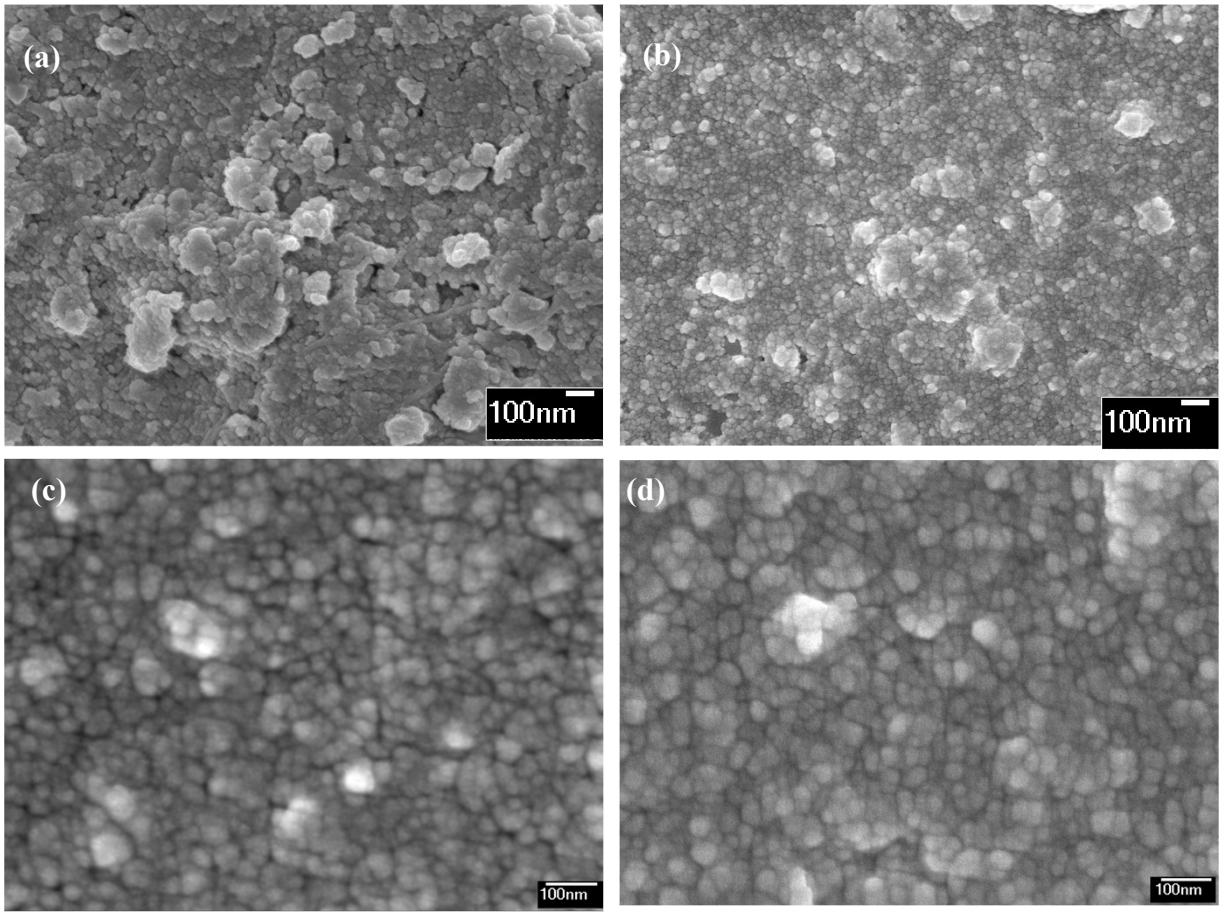

Fig. S8 SEM image of as deposited and annealed film of $Zn_{1-x}Ga_xO$. (a) as deposited film of x=0.02 (b) annealed film of x=0.02 (c) as deposited of film x=0.0 and (d) annealed film of x=0.0.

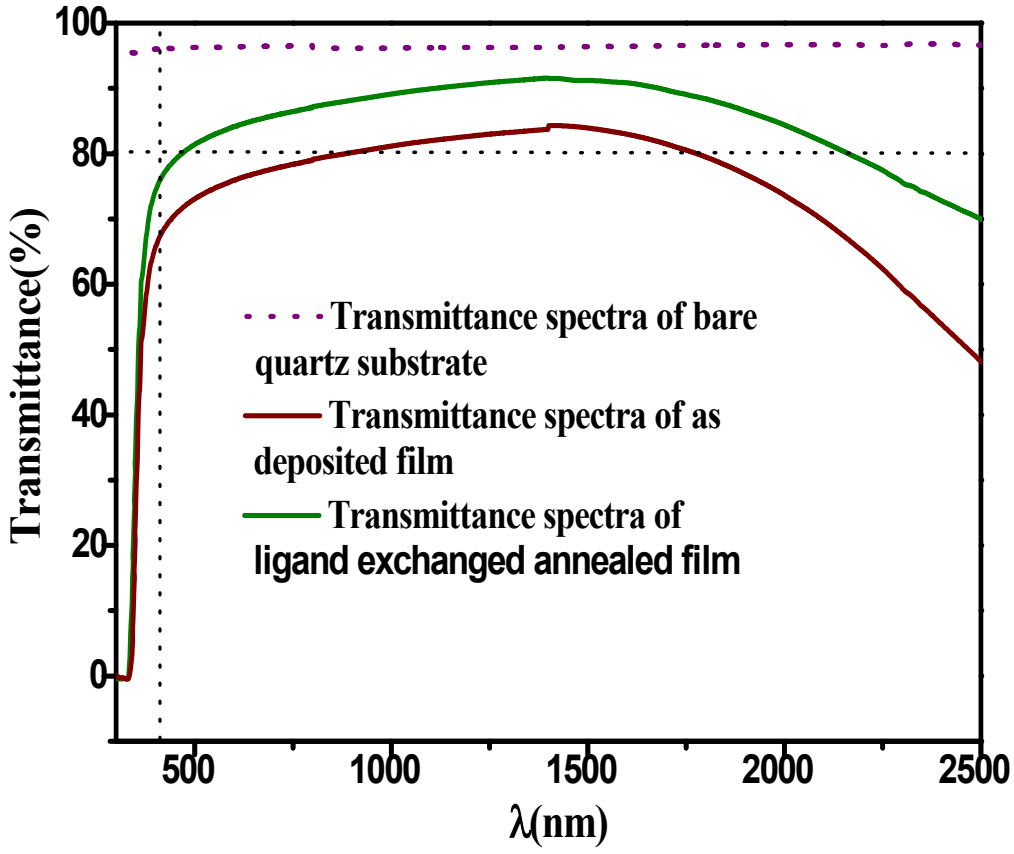

Fig. S9 UV-Vis-NIR transmittance (%) plot of bare quartz, as deposited and ligand free annealed films of $Zn_{1-x}Ga_xO$ (x=0.02) deposited on quartz shows %T > 80%, transparent in visible region and plasmonic absorption in NIR region for annealed film.

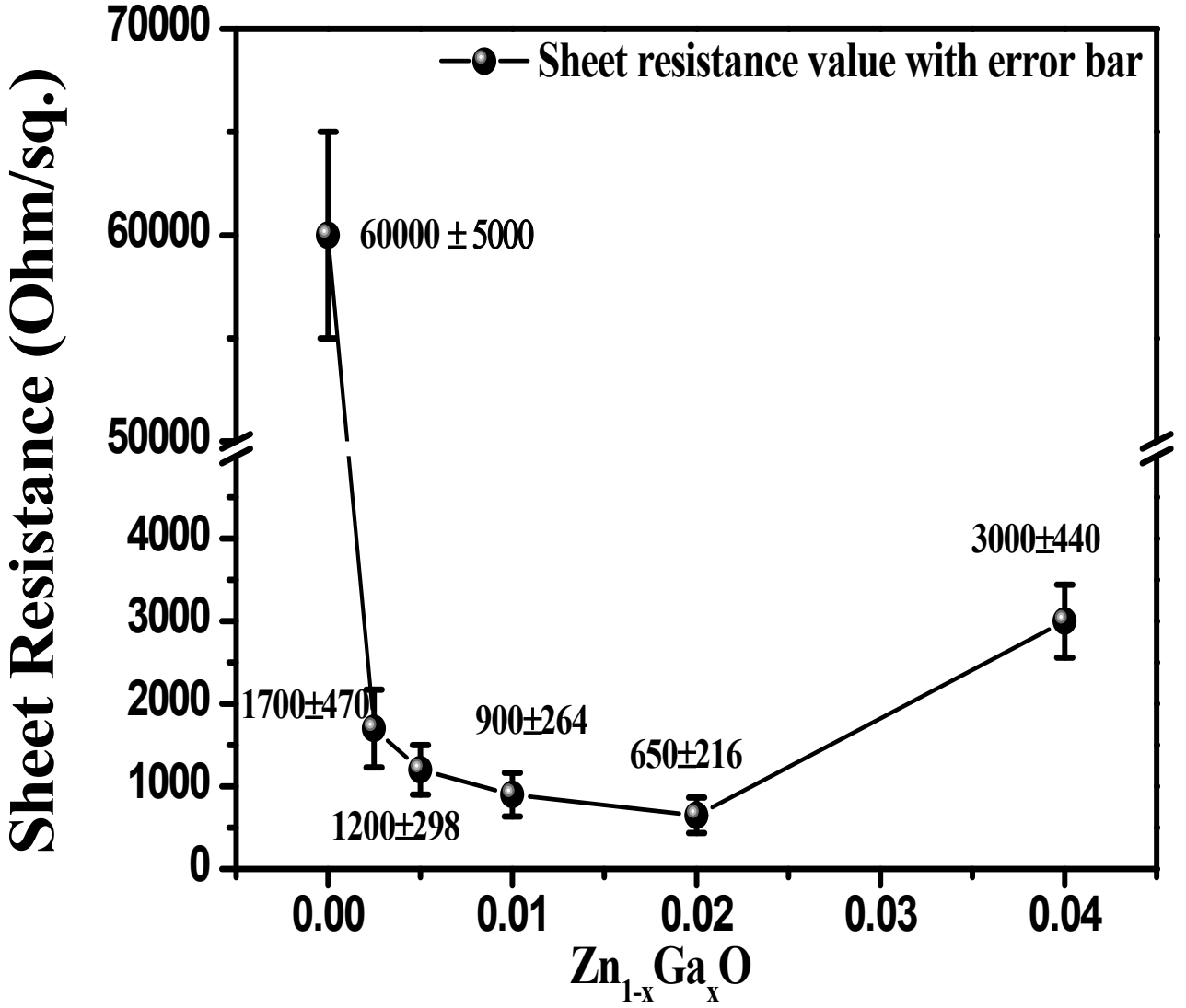

Fig.S10 Five films prepared under similar conditions for the each composition. Room temperature sheet resistance of $Zn_{1-x}Ga_xO$ films with error bar for (x=0.0, 0.0025, 0.005, 0.01, 0.02 and 0.04).

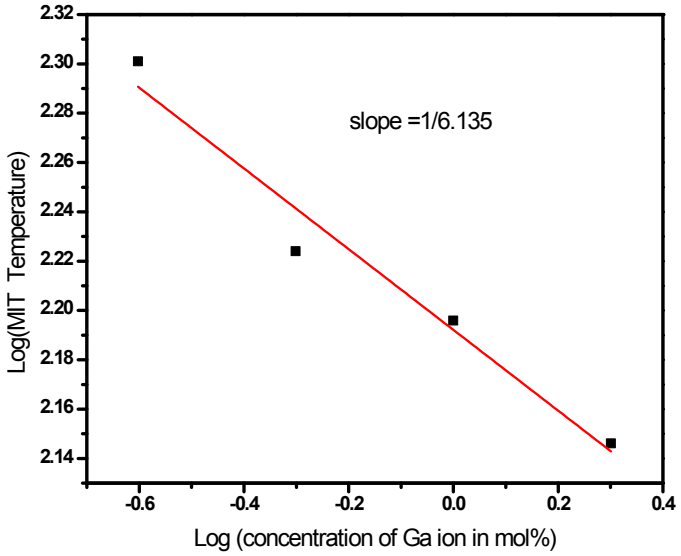

Fig.S11 Linear fit of log of Metal semiconductor transition temperature vs log of mol% Ga doping concentration

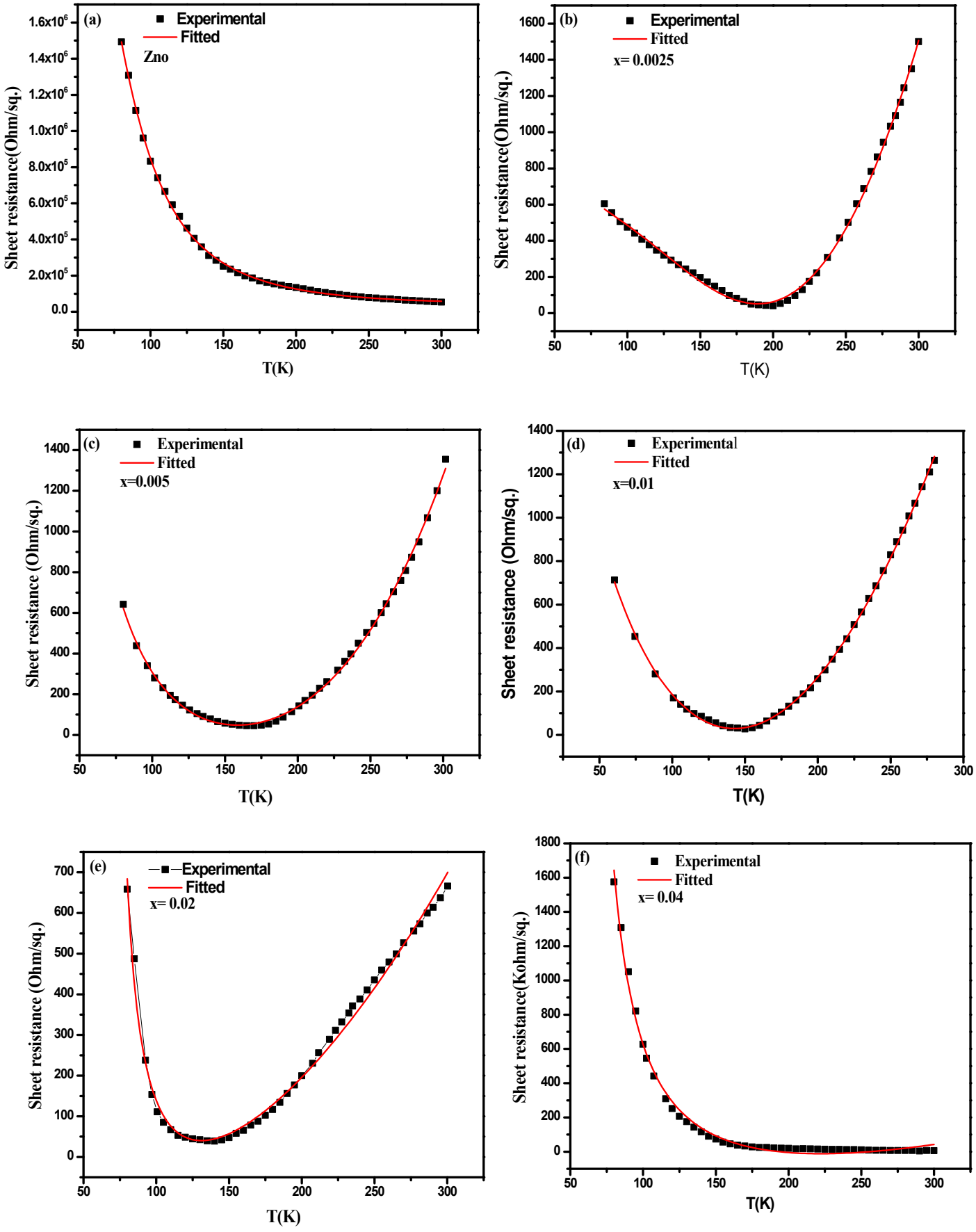
(a)
Experimental
Fitted
Zno
Sheet resistance(Ohm/sq.)
T(K)
(b)
Experimental
Fitted
x= 0.0025
Sheet resistance(Ohm/sq.)
T(K)
(c)
Experimental
Fitted
x=0.005
Sheet resistance (Ohm/sq.)
T(K)
(d)
Experimental
Fitted
x=0.01
Sheet resistance (Ohm/sq.)
T(K)
(e)
Experimental
Fitted
x= 0.02
Sheet resistance (Ohm/sq.)
T(K)
(f)
Experimental
Fitted
x= 0.04
Sheet resistance(Kohm/sq.)
T(K)

Fig.S12

Table:S1 The fitted parameter for equation (5) with $a_1 T^{p/2}$ replaced by $a_4 T^{3/2} + a_1 T^{p/2}$.

Samples	**a 1**	**p**	**a 2**	**a 3**	**a 4**	**R_0**	**Adj R**
ZnO	6.11967x10^{-10}	3.8594	4.18795x 10^{-7}	0.26645	-7.44787x10^{-8}	-11186.93311	0.99928
X=0.0025	3.19711x10^{-7}	2.82618	3.52053x 10^{-5}	0.07477	-4.51283x10^{-6}	-8955.79176	0.99789
X=0.005	4.02345x10^{-7}	2.46172	1.46435x 10^{-5}	0.08291	-2.08315x10^{-6}	-18829.46422	0.99813
X=0.01	4.47102x10^{-7}	2.86923	6.02149x 10^{-5}	0.03869	-5.58869x10^{-6}	-2873.68986	0.99943
X=0.02	9.77834x10^{-6}	2.9912	- 6.43296x 10^{-4}	0.01063	0	-285.37296	0.9916
X=0.04	2.24156x10^{-6}	3.05662	- 1.45211x 10^{-4}	0.00292	0	-309.94464	0.99263